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THE FOUNDRY

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Practical articles pertaining to the trade in all its branches are solicited and will be paid for.

We can begin subscriptions with the current number only.

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Trade Outlook.

Complaints are heard that founders are showing a disposition to withhold the placing of orders for iron in the hope that concessions will be granted them by furnaces or their representatives, and in this they have been partially encouraged by Southern sellers. Considerable improvement is noted in transportation facilities and the general shortage of fuel and iron prevailing during the early part of the year has almost disappeared. Under these circumstances the founder probably feels that the delaying of contracting for material for the latter part of the year can cause him no loss.

The building of new foundries and making additions to old shops has taken another spurt during the past thirty days and more of this kind of work appears to be going on than at any time during the past two years. True some of these enterprises are on a rather small scale, but in the aggregate they will increase the foundry capacity in no small measure. Orders for castings seem as plentiful as the foundries can handle and the granting of wage advances and other concessions to employes indicate that the supply of workmen is not any larger than necessary, in spite of the increased output attained through the installation of molding machines and other equipment.

Shop Orders.

In any foundry it is often found better and cheaper to make a great many articles for use in the plant, rather than to buy them ready made. Of course it depends largely on the kind of a plant it is, the number of different departments there are, the style of goods manufactured, and the general capacity of the works as to what can be more advantageously made "at home;" but the majority of castings can, as a rule, be made in your own shop, and if a good pattern shop is run in connection with the foundry and machine shop, with a good class of mechanics, it will not be found necessary to buy many of the articles commonly needed around a place of this kind. Such things as rammers, stands for emery wheels, weights for flasks, the flasks themselves, parts for machines, turntables, etc., can be made at a great saving, in time, as well as money.

It is highly important to have a system of keeping accurate costs of all articles of this kind made for the use of the shop, and it is the purpose of this article to outline the methods in use by our concern in this connection. This system is not entirely original, but we think it presents some features which are unique, and may be of interest.

The first requisite in a system of this kind, as in all well regulated shop bookkeeping, is that there must be no work or articles of any kind made, without a properly written shop order, authorized by the office, which is to be returned there as soon as the work is finished. This is a little difficult to enforce at first, as both men and foremen naturally think that if a thing is needed, there should be no necessity for what they term "red tape," and that the proper thing to do is to proceed with the work as rapidly as possible. If, however,

OFFICE COPY. ORDER NO. A 7

KEYSTONE FOUNDRY COMPANY.

To

PLEASE PREPARE FOR Foundry

THE FOLLOWING, TURNING IN ORDER WHEN WORK IS COMPLETED.

DATE. March 1, 1903

NUMBER	ARTICLE	PATTERN NUMBER	WEIGHT	MACHINE WORK
100	Rammers	237		
100	Butts	238		
100	Handles			
	Wooden pattern necessary for butts			
	we have pattern for rammer.			

KEYSTONE FOUNDRY COMPANY

Per R. W. M.

REQ. No.		PRICE		
ACCT		CLASS	COST	

SHOP ORDERS. FORM 1.

the principle is explained in a sensible, man-to-man way, this will soon adjust itself. We have little trouble from this source, as the reasons for it are now thoroughly understood through the shop.

Let us suppose that 100 rammers, with handles and butts, are needed in the foundry. An order is made out after the manner shown in Form 1. This form is made out in five carbon copies, one to be retained in the office, one each for the foundry, machine shop, blacksmith shop and pattern shop. These are given to the factory clerk, and he distributes them to the departments through which the articles in question must pass. In the present instance there is no blacksmith work needed, so he fills in the names of the foreman of the other departments, in the space provided for the purpose, destroying the blacksmith shop copy. It is first necessary to get the patterns ready, so he first takes the order to the pattern shop, where a man is set to work on it. The clerk makes out a card, Form 2, which shows the time the workman started on the job, and as soon as the work is completed and the foreman of the department turns the order in, which is always done immediately after it is ready, he notes the time and turns the order in to the office. The foreman is careful not to receive an order before he is ready to set a man to work on it, so there is no discrepancy about the time. The material used is noted by the foreman on the order.

The patterns being ready the foundry

KEYSTONE FOUNDRY COMPANY—DAY WORK TIME CARD.

NO. 86 DEP'T. Pattern SHOP ORDER NO. A7

NATURE OF WORK Ramming 100 Rammer handles

DATE 3/1/03 SIGNED Halloran

BEGAN 3/1/03 FINISHED 3/4/03

OVERTIME BEGAN FINISHED

TO FOREMAN:—Return this card to office with order immediately after completion of order, giving name of man engaged on order, and your count of his time.

KEYSTONE FOUNDRY CO.
C. W. HOWELL, Manager.

MORNING.								AFTERNOON.								This Space for Office Use.
BEGAN.				FINISHED.				BEGAN.				FINISHED.				
7	15	30	45	7	15	30	45	1	15	30	45	1	15	30	45	TIME 3 da 9 hrs
8	15	30	45	8	15	30	45	2	15	30	45	2	15	30	45	RATE 3.25
9	15	30	45	9	15	30	45	3	15	30	45	3	15	30	45	VALUE 11.95
X	15	30	45	10	15	30	45	4	15	30	45	4	15	30	45	
11	15	30	45	11	15	30	45	5	15	30	45	5	15	X	45	CHARGE
12	15	30	45	12	15	30	45	6	15	30	45	6	15	30	45	

SHOP ORDERS. FORM 2.

order is given out. As a production sheet is made out each day which gives the amount of work put up by each man, it is not necessary to make out any extra time card, the labor on any order being clearly shown without additional clerical work. All that is necessary in the foundry is for the foreman to turn in his order as soon as it is finished, it being returned to the office also. It is now necessary to drill the rammers and butts and fit the handles to them. This is done in the machine shop and is

NAME **PATTERNS & FLASK** ORDER NO. A7

ARTICLE 1 Rammer butt pattern JOB NO. #438

DATE BEGUN 3/1/03 DATE FINISHED 3/1/03

MATERIAL	WEIGHT	RATE	COST
CAST IRON			
" "			
COKE			
SAND			
CORE OIL			
FACING			
LIMESTONE			
LUMBER	1½ Board	3½c	.05
SCREWS			
INCIDENTALS			.04
BRASS			
WROT IRON			
TOOL STEEL			
COST OF MATERIAL			.09

LABOR	HOURS		COST
FOUNDRY			
PATTERN ROOM	2	35	.70
BLACKSMITH			
MACHINE			
CLEANING			
NON PRO			
COST OF LABOR			.70

TOTAL COST .79

SELLING PRICE .77

PROFIT 1.96

SHOP ORDERS. FORM 3.

assigned to one man by the foreman, a card being made out in the same way as in the pattern shop. The order is now completed, and all copies and time cards are brought to the office by the factory clerk. To preserve a permanent record, a card is used as shown in Form 3. One of these cards is made out for the pattern, and one for the rammers. These cards provide space for all material and labor, and are compiled from the data furnished by the orders, time cards and production sheets.

These cards are 4x6 and are filed according to their order numbers, a numbered tab on the upper edge of each card giving the last or unit figure of the order number. The guides are numbered by tens. Thus, order 23 would be made with a "3" tab, and would be found between the guides 20 and 30. Space is provided on the cards for material used and for labor spent on the job. The cost of all material to one pound of good castings is on an average 1c at the present prices, this of course being governed by the variations in iron prices and other material.

When these cards are first made out they are put in a compartment in the desk, and kept there until the end of the month, when they are entered on the labor distribution sheet. This sheet has columns for each of the principal accounts to which the different articles are charged, a double column being provided for each account, one subcolumn for supply and one for labor. This enables us to keep the labor distribution straight in the ledger without it being necessary to go over each separate time card and adjust the distribution in the pay roll book. We tried both ways, and they checked almost exactly, so we adopted the plan described here as the shortest and easiest. In addition this method gives the proper credit to the supply account, it being the idea to charge this account with only such material as should be used in merchantable goods. The cards being entered on the distribution sheet. Such orders as represent actual equipment, distinguished from orders for repairs, etc., are entered in the Inventory book in order to maintain a perpetual record of equipment, patterns, etc. The book we use is an ordinary journal ruled with double money columns, ample space being left between the Equipment, Patterns and Flasks, Supply and other inventories kept in this book, in order that these different accounts may be kept separate, and show at all times the value of the supplies of various kinds on hand. Of course the actual supply account cannot be kept in this way, as it is constantly changing, but tools, patterns, etc., can be kept nearly accurate. The foreman keeps the office posted as any patterns or equipment wear out or are destroyed, it being the usual custom to note on the order when the articles represented by the order are to replace other articles worn out or destroyed. The inventories can then be adjusted accordingly. The regular stock taking is gone through with at the end of each six months as a check on the perpetual inventory in the same way as it would if no such inventory existed. We expect, however, if the perpetual inventory continues to be satisfactory, to drop the usual stock taking entirely, except supplies and finished product. We have in addition special records for supplies and finished castings which will be described at another time.

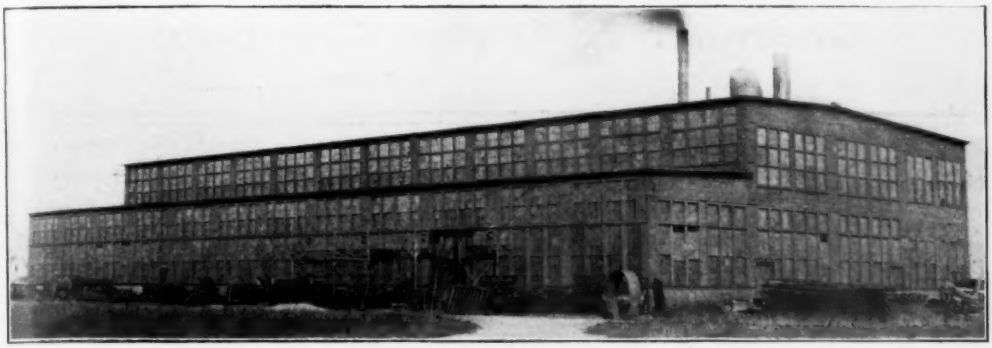
The system given above would not of course be satisfactory to every concern, as everyone has his own mode of keeping his books and records. With modifications to suit the business, however, we think that it could be used to advantage either in part or as a whole by a great many foundries who use no method of keeping track of matters of this nature.

R. W. MACDOWELL.

Determining the Quality of Molding Sand.

In a letter to the trade the Garden City Sand Co., Security Bldg., Chicago, give a rough outline of a method for analyzing molding sand that furnishes fairly accurate results and is as follows:

Heat to dryness and pulverize in a mortar; weigh out a specific quantity (one gram is a good quantity to deal with). Boil with concentrated nitric acid until sand is white. Filter, dry and weigh; number of centigrams is percentage of silica. Precipitate iron in filtrate with sodium hydrate. Filter, dry and weigh; gives iron. Precipitate alumina in filtrate with ammonium hydrate. Filter, dry and weigh, as before. In each instance, number of centigrams gives percentage of substance present in the sand. The presence of lime or magnesia can be demonstrated by dropping a few drops of hydrochloric acid on sand. Unless sand bubbles noticeably there is not sufficient of either present to injure the sand.



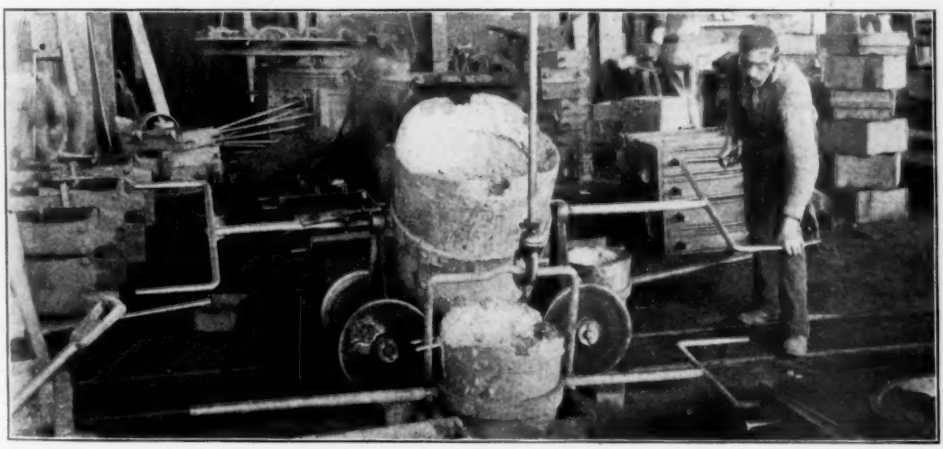
NEW FOUNDRY OF THE CHANDLER & TAYLOR CO.

The Chandler & Taylor Co.'s Foundry.

The Chandler & Taylor Co., of Indianapolis, Ind., recently completed a new foundry at their Rosemont plant, the new location at which the company's manufacturing operations will probably be centralized in the near future. The business of this concern was founded in 1858 by Chas. P. Wiggins and Thos. E. Chandler under the name of Wiggins & Chandler. Mr. Wiggins retired in 1863, when Franklin Taylor took his place and the firm became Chandler & Taylor. The business began in a small way and was operated as a partnership until 1888, when the Chandler & Taylor Co., was incorporated. The present officers are: W. M. Taylor, president; Ambrose P. Stanton, vice president; F. M. Ayres, treasurer and C. E. Swain, secretary.

Steam engines and saw mill machinery are the leading specialties of the Chandler & Taylor Co. The new foundry is of fireproof construction, well lighted and heated by a hot air system. It covers an area of 120x216 feet, the main floor being covered by a 10-ton electric traveling crane, while the side floors are provided with air hoists of sufficient capacity to take care of any work being molded there. The iron is brought to these parts by ladle cars, running on a narrow gauge track which reaches all parts of the foundry and yards. Hinged flasks are largely employed, even for molds of such a size as require the crane to handle them. The form of trunnions used is such as avoids all jarring and needless to say this arrangement also comes in handy when any part of the mold has to be rolled over.

More attention is being paid to the handling of iron and fuel on cupola scaffolds and where new works are being erected it is the general rule to build cupola platforms, of



DISTRIBUTING IRON TO LADLES ON SIDE FLOORS.

FORM NO. 139.

CUPOLA REPORT

Chandler & Taylor Company

Date.....

Charge.	Coke.	Kind of Pig Iron.					Scrap.	Total.
.....	.....	.....	.....	.....	.....	.....	.....	.....
1st.								
2d.								
3d.								
4th.								
5th.								
6th.								
7th.								
8th.								
Totals.								

Total lbs. of Pig .....

.....Coke Returned

.....Coke Consumed..... lbs. Iron melted per lb. Coke.

Bad Castings - - - - .....

Gates - - - - - - .....

Total lbs. Iron Returned - .....

Total lbs. Good Castings - - .....

Duration of Blast - - - .....

Lbs. Iron melted per hr. - - .....

Blast Pressure - - - - .....

Time Fire is Started - - .....

Time Blast is Put On - - .....

Time of First Tap - - - .....

Time Blast is Shut Off - - .....

Diameter of Cupola - - - .....

REMARKS: (As to accidents, etc.).....

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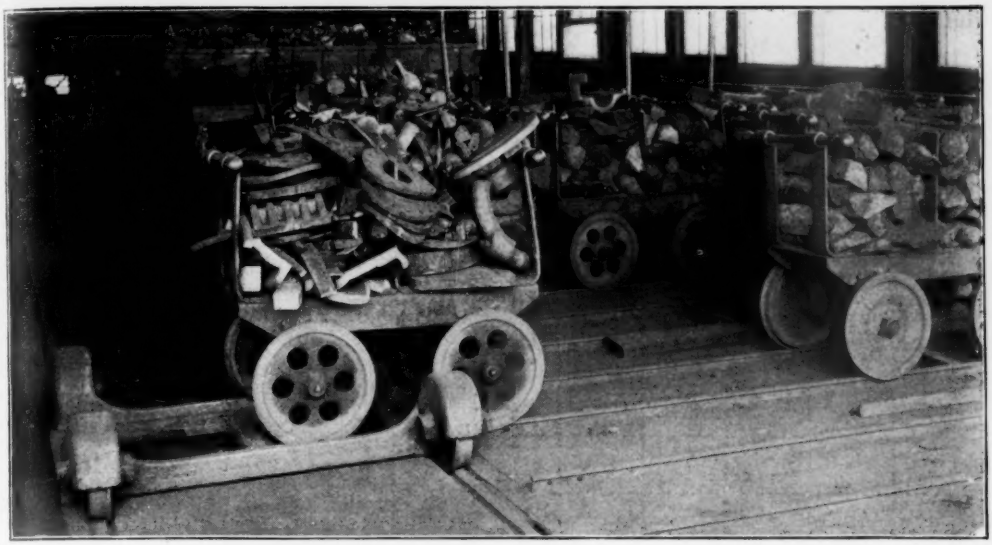
FORM OF MELTING RECORD ADOPTED BY THE CHANDLER & TAYLOR CO.



SYSTEM OF HANDLING CUPOLA CHARGES AT THE CHANDLER & TAYLOR CO'S FOUNDRY.
A car with charges entering transfer car on track in front of cupolas

such a size that they will at least accommodate a day's requirements in the way of material. At the foundry of the Chandler & Taylor Co., liberal room has been provided in the vicinity of the cupolas, the whole being covered by a system of tracks on which cars, loaded with coke and charges of iron, may be stored in sufficient numbers to meet the capacity of any heat. A track extends the whole length of the platform, and reaches the immediate vicinity of the cupolas, and another track, parallel with this, is laid at the other side of the platform. Each of these tracks is provided with a transfer car, as shown in the illustrations, and between them are located the storage tracks, from any part of which the cars are readily sent to the cupolas. As shown the cars for iron have an extension at their centers so that two charges of either pig iron or scrap may be placed on one car. The coke cars are built of sheet steel and

A CAR OF COKE ON TRANSFER CAR AT REAR OF STORAGE TRACKS.

FOUNDRY TICKET.

Form 133.

Pieces ..... Wt. .....

Name ..... No. .....

DATE	Moulds Made	Castings Made	Castings Defective	HOURS	MINUTES	RATE	COST	Per Cent. Help	TOTAL Straight	COST Over Time
TOTAL										

Average cost moulds ..... Average cost castings ..... Loss .....

Total pounds ..... Cost per pound .....

FORM OF MOLDERS RECORD BLANK ADOPTED BY THE CHANDLER & TAYLOR CO.

Form No 24.

Foreman's Statement of Men Absent.

..... 190....

No.	OFF	A. M.	P. M.	No.	OFF	A. M.	P. M.
	"				"		
	"				"		
	"				"		
	"				"		
	"				"		
	"				"		
	"				"		
	"				"		
	"				"		

..... Foreman.

DAILY REPORT BY FOUNDRY FOREMAN OF ABSENT EMPLOYES.

Form 26

SHORT TIME MEMORANDUM.

.....

WORKED

From ..... Until .....

..... 190 ....

.....

FOREMAN.

FORM OF MEMORANDUM OF EMPLOYES WHO DO NOT COMPLETE A FULL WORKING DAY.

Form No. 31.

Over Time Memorandum.

.....

WORKED

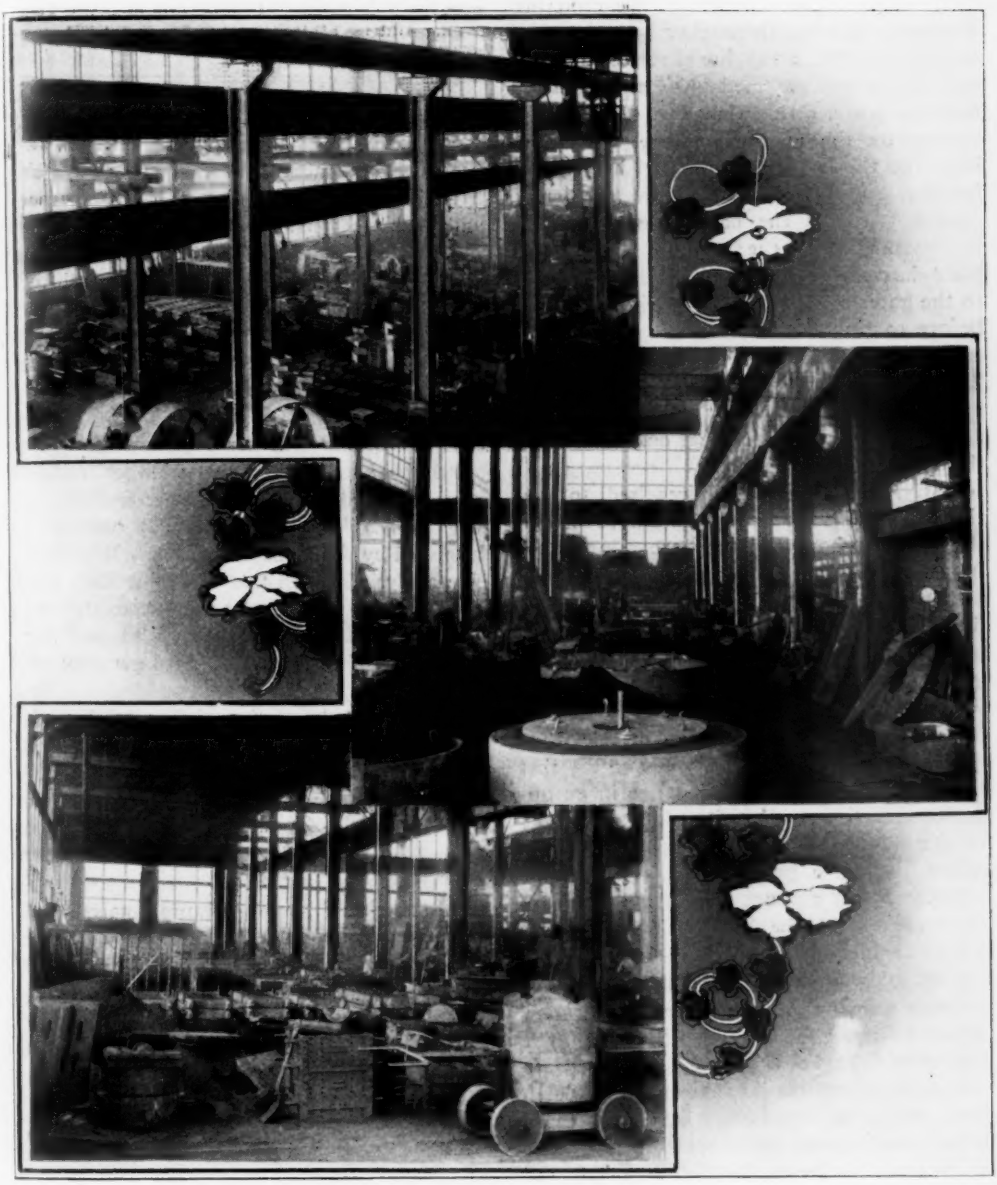
From ..... Until .....

..... 190 ....

.....

FOREMAN.

FORM OF REPORT OF OVERTIME WORKED BY EMPLOYES.



SOME VIEWS FROM THE FOUNDRY OF THE CHANDLER & TAYLOR CO.

have hinged sides, so that they may be easily relieved of their contents. This system of handling material works well and avoids all confusion, so common where the charges have to be weighed on the cupola platform.

Nearly all the engine pulleys turned out at this foundry are made in green sand altogether and cast with the rim open. A set of holes is bored in the rim pattern, through which pins are inserted in the center of each arm, and thus the latter are sure to be centrally located. As pulleys of the same diameter are made of different widths of face, each pattern has a vertical row of holes fitting with the arms, enabling these to be placed where wanted with little or no measuring or need for repeated trials to be sure that the arms have not been rammed out of place. When the arms are attached to the

rim pattern after this method the molder may go ahead and bed in the arms, without giving a second thought to the centering of same. When the anchor carrying the sand above the arms has been bedded in and the pattern rammed up to the required height a plate, fitting that part of the mold carried by the anchor or lifting plate, is bolted to the latter and this part hoisted off by the crane which gives the molder a chance to finish the balance of the mold and withdrawing the arms. The upper plate has a central opening giving access to the gates and is of course weighted down before casting.

Many of the cores used in the Chandler & Taylor foundry are made on special arbors or grids and it is obvious that there is a decided advantage in this, first in that only about half the usual amount of core sand is necessary, and secondly, a shorter time is required to dry the cores. Ordinary core sand is used with these core arbors and they are rammed up in a corebox with surprising rapidity, as the core maker does not have to look after rodding or securing the cores in any way, and perforations in the arbor take care of the venting. The core oven car employed is provided with bearings having a small amount of friction. This type of a car has previously been described in our columns, suffice it to say that the axle moves a certain distance in an opposite direction to that in which the body of car moves. These bearings require no oiling, in fact a bearing which has to be oiled does not amount to much for a core oven car, when the latter is subjected to a high temperature every day, and the drying up of whatever lubricants are applied probably gums up the bearings and increase friction instead of abetting it. The Chandler & Taylor Co. have adopted certain forms of record blanks, the better to keep track of what is being accomplished in their foundry, and we reproduce facsimiles of a few of these. J. W. Sturgeon has charge of this department.

The S. B. Sexton Stove & Mfg. Co., of Baltimore, Md., has been incorporated to continue the business of S. B. Sexton & Son. The capital stock of the reorganized company is $200,000.

It is reported that the York Bridge Co., of York, Pa., will establish a foundry to supply itself with castings.

CAST IRON NOTES.

Devoted to inquiries from Practical Foundrymen on the subject of Melting and Using Cast Iron. Address all inquiries to W. J. KEEP, care of The Foundry.

ANOTHER FOUNDRY WITH HARD IRON.

Question. "We take the liberty of again addressing you on the subject of pig iron. We have just passed through another experience with hard castings and in some cases the shrinkage of a ½-inch bar has been as high as .185-inch, when we could no more drill the bars than hardened steel. At the suggestion of a prominent Eastern iron merchant we had the irons that we were using analyzed. There was one pig, so hard that we could scarcely drill it, which showed by analysis 3.244 per cent silicon and .014 per cent sulphur. The merchant stated that judging from its fracture it would not contain over 1.50 per cent silicon. The analysis compared favorably with that furnished by the furnace that shipped the iron. The analysis showed that the other irons that we were using contained 3.301 silicon, .019 sulphur, 3.113 Si. and .029 S., 2.313 Si. and .037 S. Our castings contained 2.596 per cent Si. and .070 S.

"You have told us that if the shrinkage is greater than the standard adopted, that is if we have hard castings, to increase the silicon. We do not however consider that the silicon is deficient in our case and we have yet to find out what is giving us trouble. Our coke shows 1.29 per cent S."

Answer. In this case chemical analysis did not indicate the trouble. The foundry writing the above makes light hardware castings and therefore would have at least 40 per cent remelt. It is not stated in what proportion they use the pig irons, but let us suppose that this amounts to equal parts of each, then we have:

	lbs.	Silicon.		Sulphur.	
Remelt.....	800 ×	2.596 =	20.768	.070 =	5.60
1st iron.....	300 ×	3.244 =	9.732	.014 =	.42
2d "	300 ×	3.301 =	9.903	.019 =	.57
3d "	300 ×	3.113 =	9.339	.029 =	.87
4th "	300 ×	2.313 =	6.939	.037 =	1.11
	2000	2.834 =	56.681	.0429 =	8.57
	Loss.	.25	Gain.	.030	
		2.584		.0729	

The results are exactly as the analyses indicate.

It is generally claimed that from ⅓ to ½ the sulphur in the coke enters the iron. In this case only the usual .03 per cent has entered

the casting. What became of the rest? 0.80 is considered the limit for sulphur in coke.

It is a common experience for sulphur in coke to harden castings and yet not remain in the casting.

The pig iron which contained 3.244 silicon and yet was so hard that it could not be drilled should have been soft and gray unless there was something else wrong.

An analysis of total carbon might have shown only 2.00 or 2.25 per cent, in which case no increase of silicon would have softened it.

The silicon and sulphur as shown by the analysis are about ideal, and we are not certain but that an analysis of all the other elements might have shown the cause of the hardness and yet it might not.

Generally an analysis of silicon and sulphur is sufficient. All pig iron is presumed to contain over 3.50 per cent carbon and with such iron hardness indicates that too large a proportion of the carbon is in the combined form.

The only practical way to change this combined carbon into graphite is to decrease sulphur or to increase silicon. The first is a difficult thing to do but the latter is very easy. Therefore the rule, when the iron is hard, increase silicon, whether you think it is high enough or not. It is your only way to soften iron.

Every founder should increase and decrease each pig iron of his mixture until he knows positively which irons soften and how much they soften. This should be done while the iron is running satisfactorily. By such experiment the founder soon knows just which iron to increase or decrease if the castings become hard. If he has an iron that shows well in silicon and sulphur but which hardens the mixture, this can be got rid of by using so little that the mixture is not affected.

With ordinary irons an increase of silicon will always soften and will reduce shrinkage. A reduction of shrinkage therefore shows that the silicon is softening the mixture, and how much.

In this individual case I do not think, with the irons generally on the market, that the silicon is high enough. I would run it up to at least 3.00 per cent. I would not use a sulphury coke if I could get any other. Why don't you always have on hand for just such cases a car of silvery iron?

SPECIFICATIONS FOR TEST BARS.

Question. "The castings are to have great strength and each will weigh about 4,000 pounds and is to support immense I beams. The engineer's specifications call for two testbars 1 inch square by 27 inches long for transverse strength and resilience. The resilience (breaking load multiplied by ½ the deflection) must not be less than 8. Two testbars 1¼ inches diameter and 12 inches long to be turned to a diameter of 1 inch for a distance of 6 inches between shoulders. The tensile strength shall not be less than 18,000 pounds per square inch. What irons shall I use?"

Answer. For the greatest strength of a 4,000-pound casting to be used as a support, if well designed, the silicon should be very low. To make a 1-inch square testbar, with high resilience, the silicon will be much too high to make a strong large casting. The engineer should not have asked for such small testbars.

The only way to do in this case is to make good testbars and if the castings are weak blame the engineer who drew the specifications. In this instance I would add about 5 per cent of steel scrap to the cupola charge. Very few engineers realize that high silicon will make a strong small casting but a weak large casting, while low silicon will make a brittle small casting and a very strong large casting. The test of a testbar should be used relatively.

Gaggers.

BY JAMES A. MURPHY.

The chemical laboratory, the physical testing apparatus and several other modern foundry appliances must take a back seat when considering points of usefulness in the production of castings with the everyday common cast iron gagger, of which there is such a plentiful scarcity in many of our foundries. Of course the stove plate, agricultural and other specialty shops use very few or none of these, but to the jobbing foundries they are indispensable and it is not economy to get along without them. To the molder in a machinery foundry a gagger is of as much importance as the pattern or sand heap. No experienced foundryman will deny this, and the best managers always try to have a sufficient supply of them within easy reach of their molders and core makers. I know of several large foundries where molders spend more time skirmishing around after gaggers than

would in many instances be required to complete the job on which they are working. After failing to find enough gaggers the molder has to fall back on his old friend in such cases, the foundry carpenter who splits up some "sojers." When these are used it many times becomes necessary to

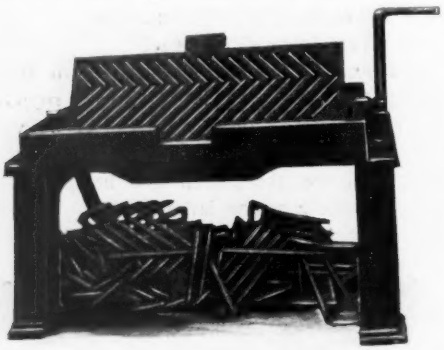


FIG. 1. CHILL MOLD FOR CASTING GAGGERS.

nail the face of the mold and I have witnessed the loss of important castings through the mold scabbing under the wood, allowing the hot iron to touch this, causing more or less of the mold to be blown to pieces.

If he can show that he had to have some gaggers it will of course be easy for him to prove that he could not produce two different kinds of castings at one and the same time. At one time our shop was so completely filled with work that I had not a foot of floor space to spare and the gagger question was about to reach an acute stage when I hit upon the plan of making a permanent mold, a sort of a perpetual motion affair which will make gaggers of good quality by the thousand and at the same time take up but very little room. The chill mold I constructed took the shape shown in Fig. 1, which worked very satisfactorily until it got red hot, when it would not drop the castings easily and we had to wait for it to cool, often assisting it in doing so by throwing water on it. This led me to get up the self-cooling chill mold, of which a plan and sectional view are shown in Fig. 2. A pipe is connected at each end by swing joint fittings, which are easily connected with a water supply through a piece of hose. There is a constant flow of water through the mold and the water used for this purpose need necessarily not be wasted, as the exhaust can be turned into a water tank, and especially in the winter time the

FIG. 2. PLAN AND SECTIONAL VIEW OF SELF-COOLING CHILL MOLD.

In common with others I have tried to keep up the supply of gaggers in the shop with which I am connected by having the younger apprentices make as many of these as they could towards the end of each day's work; as I note that the making of a few gaggers is often a great excuse on the part of a molder for not doing a full day's work.

men will be very glad of a chance to obtain warm water.

The gaggers on each side of the chill mold are gated in such a way that when the plate is turned over the gated side is always next to the pourer. Perhaps some would believe that the gagger would crack at the heel on account of contraction being pre-

vented in the rigid mold, but the fact remains that it does not do so. The gate is so designed as to overcome fins and sharp projections which are liable to cut the hands. To facilitate the removal of the gagger from the gate there is a small nick where these join. One of these water jacketed molds will supply the largest shop in the country with a sufficiency of gaggers, while a mold made of a fair thickness, without the water arrangement, will take care of a foundry having as many as fifty molders. With a solid mold the limit is reached when it gets red hot, while with the one having a self-cooling attachment the capacity is only limited by the length of the heat and the physical strength of the helper who pours them.

Any way it is made, the cast iron gagger is the cheapest, and when turned out after the method shown its cost is almost nil, for when broken up it can be remelted, so practically nothing goes to waste. Wrought iron gaggers are preferred in some foundries and thought to be more suitable for several kinds of castings, particularly when these are heavy and made in dry sand, also for large cores. While the wrought iron article is often very handy, I like to limit its use wherever practicable. The cost of wrought iron gaggers is very great when compared to those made of cast iron; again the former seldom retain their original shape for any length of time and the molders will spend much valuable time in straightening them. They find their way to the core room in a relatively short time, where they soon become a sorry looking heap of twisted scrap.

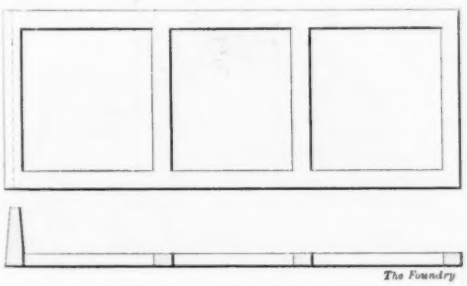


FIG. 3. SPECIAL GAGGER FOR DEEP LIFTS.

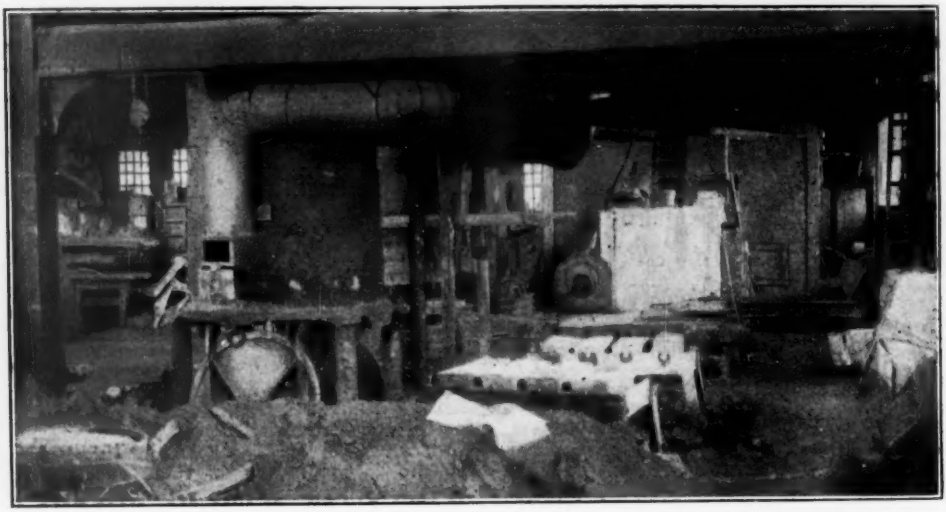
Fig. 3 is a cast iron contrivance molded in the same manner as a gagger, which takes the place of long wooden soldiers and the hanging wrought iron gaggers, and not only do I find it safer but a great time and material saver. I seldom find it necessary to bar a large cope to the outlines of the job, preferring to have straight bars about seven inches deep across the top of the cope and putting these hangers down in the various parts of the mold. By this method rebarring the cope for different jobs is avoided and almost any job can be made in the flask which will go inside of the frame. Flasks are sometimes costly articles and the less we can get along with the more money we are in pocket. Bars are also a great hindrance to fast ramming and it is wise to dispense with them as far as possible.

Many dropouts, drawdowns and other defects are directly attributable to an insufficiency of gaggers. Many molders are lazy and on general principles dislike to contribute their share towards maintaining a supply of same. Instead they prefer to steal them from their partners even though they have to come to the shop early in the morning or stay after quitting time to accomplish this. This makes the balance of the molders lazy in this respect also, as they will not, as they say, make gaggers for the whole shop. In some shops it is no uncommon occurrence to find molders fighting and being discharged over this question of gaggers and more or less bad feeling prevails through the selfish actions of a few men. The borrowing of a few gaggers is often the first test of friendship applied by a stranger, and I have on several occasions seen men throw up their jobs on account of being refused, when several piles of gaggers were buried by the old hands for safe keeping. There is no fairy tale about this, as it is an every day occurrence in all sections of the country, and the question naturally arises, who is the principal loser? The best way to stop this annoying, petty wrangling among the men as well as to insure better work and more of it is to let each man have plenty of gaggers and not have any individual have any special claim on any of them. Since we introduced the machine mentioned in this article for making gaggers we have found it a boon to molders and core makers alike, and we confidently believe that the waste rod pile as well as our stack of bad castings will cast a much smaller shadow on our annual profits in the future.

Cottrell's Little Cupola.

BY JOHN RANDOL.

The Cottrell Printing Press shops, Westerly, Rhode Island, employ about four hundred and fifty men altogether, and make almost everything they require except shafting, steel bars, tubes and sheet metal, in their own shops, preferring to depend on themselves and their own selection of raw material rather than to contract with manufacturers in special lines.

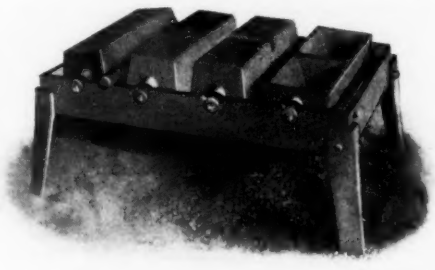


VIEW IN REAR OF CUPOLAS IN THE COTTRELL FOUNDRY, SHOWING LOCATION OF CHILL MOLDS FOR RECASTING IRON.

Their foundry, employing seventy-five molders, is very completely equipped with cranes, compressed air lifts and other modern tools, and furnishes the company all of its castings, many of which are difficult to make owing to the large size and awkward shapes of the frame castings, and also because of the soundness demanded in castings for cylinders and press beds. The press cylinders weigh from one to five thousand pounds each, have heads at each end and two or more sets of intermediate arms, and they are expected to be perfectly sound, without speck or blemish anywhere. To aid in attaining this result these castings are made in dry sand, the Cottrell foundry having a very large core-oven capacity for its size.

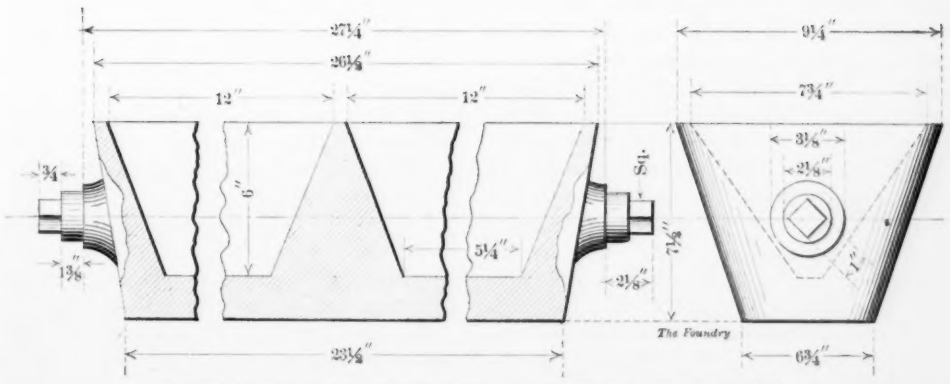
Printing presses are extremely complicated structures, using a great number of gears and cams, some of which are subjected to hard service, and almost all of which are made of cast iron. The quality of the metal therefore becomes a matter of the highest importance to the successful operation and durability of the presses. The Cottrell foundry has been in operation for fifty years, and during that time has made nothing but castings for printing presses, and, as might be expected, is very highly specialized in certain directions.

For many years certain castings were a source of trouble from want of uniform texture and perfect freedom from blow holes. The gears and cams in particular gave trouble because of differences in quality and durability, and the cylinder shaft boxes were also a source of annoyance. The chief trouble arose through castings made from apparently identical cupola mixtures failing to show the same durability in



A BATTERY OF CHILL MOLDS.

service. In some presses a certain piece worked well and had a long life. In other presses the same piece wore out immediately. Some cylinder journal boxes wore smooth and acted perfectly under the heavy loads imposed, while others, seemingly the same and finished in the



SECTIONAL VIEWS OF CHILL MOLD USED IN THE COTTRELL FOUNDRY.

same way, as nearly as possible, would not answer. The foundry foreman finally decided that the trouble came from an imperfect mixing of the charge in the cupola and ladle, and advised melting the iron twice for such castings as gears, cams and boxes, the iron in the first melting to be poured into iron pig molds, and later remelted in a small special cupola, used exclusively for particular castings.

Following out this policy a small cupola was purchased and the pig iron molds shown in the illustration installed, when all of the irregularities in the castings, which had formerly given trouble, disappeared. A heat is taken off every day in the Cottrell foundry, the large cupola having a capacity of about 12 tons, while the small one will readily melt 3,000 pounds. The iron which is remelted for special castings consists of charcoal pig iron and a certain amount of scrap, and as no outside scrap is purchased the quality of the homemade scrap is known. When the last charge has been placed in the large cupola each day the iron which is to be melted in the small cupola the next day is charged, and at the proper time run into the chill molds. The pigs are triangular in section and weigh about 50 pounds each. Two sets of chill molds are provided, which will take care of about 800 pounds of iron, and as the pigs cool off very quickly the molds may be turned over almost as soon as poured, leaving the molds ready to be filled again. It takes but a very short time to melt down this iron and since this method was adopted there have been no irregularities noticed in the wearing qualities of the castings. While there is a small expense attached to this operation, it is considered that the results obtained more than justify this. This system of securing uniformity in special castings has been in use at the Cottrell shop for about fifteen years. The fracture of the remelted iron is very fine and close grained and the castings made therefrom, while not as soft as those made from the regular mixture, are extremely strong, tests having shown nearly double that of average castings.

Melting Steel With Cast Iron.*

BY R. P. CUNNINGHAM.

The demand for castings of high tensile strength has increased to such an extent that many foundrymen have found the method of melting a certain percentage of soft steel with their iron a simple, safe and sure means of bringing their castings up to the required specifications in regard to strength. Probably no class of manufacturers are called upon to produce castings of high strength so often as pump and engine builders; yet tool makers find that owing to the high speed at which modern tools are run today they are obliged to make castings that will stand a higher strain than a few years ago. Pump builders a short time ago considered a pump that was working under a pressure of 2,000 pounds as being up to the limit, but now it is no unusual thing to receive an order for a pump working under a pressure of double that amount, and even 5,000 or 10,000 pounds is often called for. In the latter case the cylinders are of cast steel, the flanges and connections, etc., are semisteel, and we have found very little difficulty in making castings that would stand this enormous pressure.

Any one familiar with pump work will

*A paper read before the New England Foundrymen's Association.

readily understand the necessity of having a perfect casting, not alone smooth and true to pattern, but clean and close grained, yet soft enough to machine easily. Many castings go through the machine shop and erecting room and fail when they are put on test. This makes it very expensive, as often the cost of machine work is many times the cost of molding. We have found that by judicious use of steel scrap we in a great measure overcome this, especially if the trouble is porosity of the casting. When melting steel with cast iron there are many things that require close attention in order to obtain the very best results. In charging the cupola one cannot be too careful and should be absolutely certain that all the material called for in the charge is put in; the weight of each material specified should be correct; and fuel and fluxes should be known by chemical analysis, so that the exact composition of all the material going into the semisteel may be known.

Our method of charging the cupola is as follows: Take, for instance, a heat of 4,000 pounds with 25 per cent steel. We first put on the bed 1,200 pounds of coke, and on top of this put 1,000 pounds of iron, then 500 pounds of steel, then 500 pounds of iron, next 200 pounds of coke, 500 pounds of steel and 1,500 pounds of iron. The coke next above the semisteel charge should be greater than between the ordinary charges, and the pig iron in the first charge above the steel should be the same as in the semisteel charge, so that if any metal should melt and run into the steel it would do no harm.

Under all circumstances in making a high grade metal we have to contend with the impurities of the fuel and material charged into the cupola other than that which we have estimated on. All impurities in excess tend to weaken the metal in tensile and transverse strength. For this reason there is more difficulty in making a successful cast when using a large percentage of steel scrap. A high percentage of steel necessarily increases shrinkage, demands closer attention to rapid handling in the foundry, and when very high tends to make all operations connected with it draw away from those of a cupola metal and approach those of a steel casting. When this extreme point is reached semisteel is out of its province as a practicable cupola metal.

The average thickness of a casting bears a relation to the percentage of steel desirable. For thin castings a small percentage may be used, while for thick, heavy castings a high percentage is permissible. This is so because the thin casting has no self-annealing power on account of its rapid cooling and the chilling effects of the mold. The thicker casting, on the contrary, on account of its slow cooling, anneals itself and opens the grain of the metal perceptibly. The same metal which in a thin casting would be hard would be much softer in a heavy casting.

My opinion is that it is more desirable to have a mixture with the smallest percentage of steel that will give sufficient strength and solidity to castings for all practical purposes.

We sometimes doubt the wisdom of the engineer when he calls for castings that will stand so many thousand pounds to the square inch, because the metal that will stand the highest test in a bar is not always the most desirable. It may be brittle or flabby with no elasticity and yet test high. What we aim for in practical foundry work is a high grade metal that will stand a fairly high test and machine easily. It is this kind of a casting that can be made with semisteel provided the rules are accurately followed.

We have found that by using two brands of iron, one very high in manganese and the other high in silicon, both low in sulphur, we can get a much finer grained casting with more elasticity than we could if we depended on ferromanganese and ferrosilicon to bring these two elements up to the desired percentage. I reason in this way: If the manganese and silicon are in the pig they are more evenly distributed than when they are put into the cupola and are depended upon to become thoroughly mixed in the cupola or ladle. We have never yet depended upon the pig iron for the entire amount of manganese and silicon wanted, but have added each in proportion. This varies according to the weight of the casting. For the average run of work it is 1¼ pounds of each to every 100 pounds of steel.

We sometimes have trouble caused by wrought iron getting into the steel scrap, or hard steel. In either case satisfactory results cannot be obtained. With hard steel the castings are full of hard spots, while wrought iron increases porousness, which is bad, if the casting is of uneven thickness. My opinion is that mixtures of this kind will in the future be used to a greater extent than they have been in the past, because the demand for these have increased, and foundrymen will readily see that by this means they can build up their present

mixtures so that these will show higher strength and other desired qualities.

[Mr. Cunningham concludes his paper by showing some records obtained from several heats, from which we gather that the loss in melting ranged from 213 pounds in a heat of 4,020 pounds to 282 pounds in a heat of 4,045 pounds. This is a loss of from 5.3 to 6.77 per cent of the metal charged, which is very excellent, in part due to the care with which waste metal was recovered to insure authentic figures on this point.

Test bars were cast at three different temperatures, the first with metal as hot as it could be procured, the second after the metal had stood for a few minutes in the ladle, and the last when fluidity was rapidly disappearing. In every case the second bars showed the highest tensile and transverse strength, the first bars without exception contained small blowholes, and the last bars, poured with dull metal, showed up badly in nearly every instance.

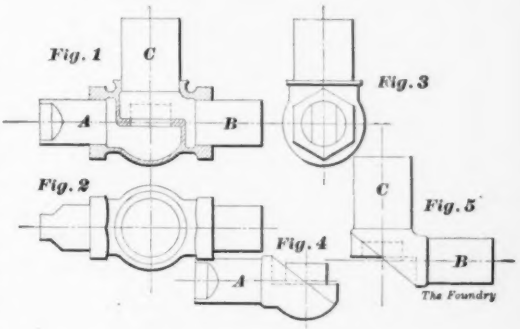
With a mixture containing 25 per cent steel, a tensile strength of 31,890 pounds and a transverse strength of 3,180 pounds per square inch were obtained. An analysis of this mixture shows its composition to be as follows: Si. 1.91, S. .06, P. .49, Mn. .74, C. C. .4, G. C. 2.7. Increasing the steel in the mixture so that this amounted to 40 per cent of the whole does not appear to have made much difference, as we find the metal shows practically the same analysis as quoted above, the tensile strength being 33,205 and transverse, 3,335. Although experiments were made covering eighteen heats, with mixtures containing from 20 to 45 per cent of steel, there is a remarkable uniformity in analyses as well as in the results of physical tests. The pig irons used were "Wharton," analyzing as follows: Si. 2.12, S. .4, P. .43, Mn. .75, C. C. .36, G. C. 2.98; and "Poughkeepsie," containing: Si. 2.3, S. .2, P. .56, Mn. .56, C. C. .3, G. C. 3.11. In explanation of the uniformity of the finished castings as shown by analyses Mr. Cunningham states that there was added to the mixture 1¼ pounds of ferrosilicon and 1¼ pounds of ferro-manganese for every one-hundred pounds of steel scrap used.—Ed.]

The Norfolk & Western Railway Co. will add a foundry to its Portsmouth, Ohio, shops.

The Wilson Foundry & Machine Works have been incorporated at Kanawha Falls, W. Va., with a capital of $30,000 to manufacture coal mining machinery and equipment.

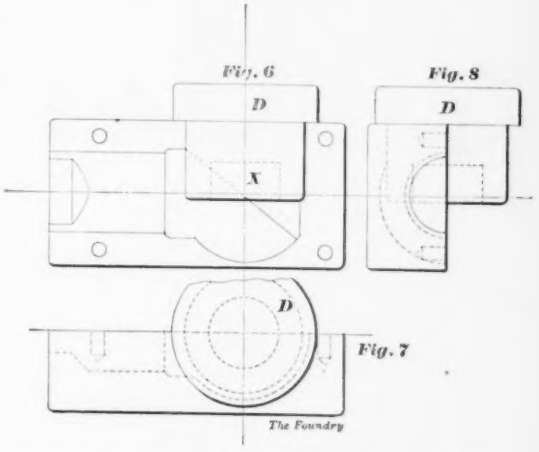
Core Boxes For Globe Valves.

As a general rule there are no more unwelcome jobs entering the pattern shop than patterns and core boxes for globe valves. It is a rather difficult job to make a well finished core box for a globe valve, and according to some methods three core boxes and



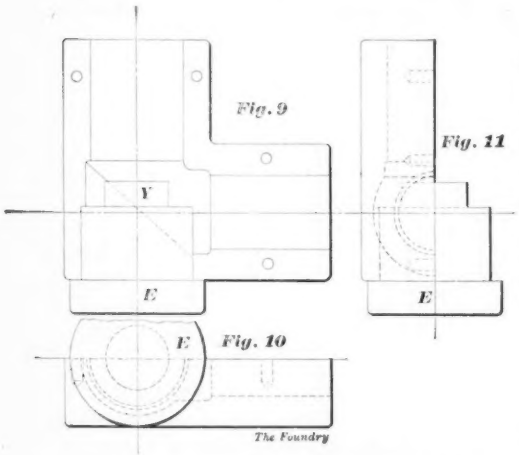
three cores are necessary to make a complete casting. By the method I follow only two core boxes are used and two cores give one complete valve.

Fig. 1 shows a sectional view of a globe valve pattern with the necessary core prints. Figs. 2 and 3 are further illustrations showing different views of same. Figs. 4 and 5 show the necessary cores for this valve. Fig. 4 is the core for the lower part or in-



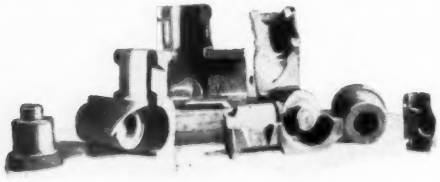
let side, while Fig. 5 is the core for the upper part or outlet. The core prints A B and C are of circular shape which I find are the easiest made and work better than the square. In order that the cores may not be set wrong into the mold I make the print A with parallel faces. The core, Fig.

4, forms the inlet and has the print which fastens to the outlet core Fig. 5 as shown in Fig. 1. The latter is in one piece only having two prints B and C. I find this is the easiest way as if this core is made in two pieces there is trouble in putting these



together and sometimes a danger exists of the cores being displaced while the mold is being poured. By placing the cores together as shown, we can get along with shorter core prints, and are thereby enabled to place more patterns in a flask.

Fig. 6, 7 and 8 are views of the half box for the cores shown in Fig. 4, with



CORE BOXES FOR VALVE CORES.

print D to form the hole, which receives the print of core Fig. 5. It is necessary that this print should be drawn out before the core box is opened. Fig. 9, 10 and 11 are all views of the core box for the outlet core shown in Fig. 5. This also has a print E for forming an opening at Y to receive the print X.

I have appended a couple of photographic illustrations showing some of the valve cores and core boxes we use, which will probably give the reader a better idea than anything else. These boxes are made of cast iron and instead of having holes and pins by which they may be fitted together,

CORES AND CORE BOXES FOR VALVE CORES.

they are provided with taper shaped edges, which have been found more convenient. I would be glad to learn of some American methods of making this class of castings. Naturally as long as cores have to be made in sections longer core prints are required. The ideal method of making globe valves would be to have the core in one piece only.

ROBERT WAGNER.

Chemnitz, Germany.

An Order System for Foundries.

A system for entering foundry orders that is satisfactory, disposes of one of the many essential details connected with the management of a large foundry.

It is often found that an order system, which has been eminently satisfactory in one foundry, does not meet all the conditions found in another foundry.

It is granted, of course, that the methods as outlined here for keeping record of foundry orders is not necessary nor desirable for a foundry where the tonnage is small, or where the castings are largely consumed by the machine shop connected with the works.

There are, however, very many foundries with a large output that make a specialty of miscellaneous jobbing orders. These conditions call for a system that will enable the manager, or order clerk, to answer promptly the numerous inquiries relative to condition of the various orders, and to do so with the minimum of labor.

In the system here described the order is written up in the office upon form 1, for issue upon the shop. One copy of this order is written for the shipper, and a carbon copy for the molding shop records, and a stub carbon copy remains in the order book to become the office record. Shipments, of course, are checked against this office record. The shipper's copy with the molding shop's copy attached is sent to the pattern man, by whom all patterns are tagged before they are turned over to the foundry. This party makes note in the column headed "Tagged" the date each pattern is

Order No. 7999

Cust. order 102–3/6

No. Pats. ..... No. Core Boxes .....

Ship to their 35th Street Mill, Pittsburg, Pa.

Via Wagon.

March 7th 1903

Brown & Brown,

Pittsburg,

Pa.

		Tagged.	3/14		3/18		3/21					
12	Mill Carriages #1000											
12	✓ Spindles #1100	3/9 1 C.B.	✓ 3 ✓ 2	300 199	✓ 4	403	✓ 3	302				
12	Coupling Boxes #1110	3/10 2 C.B.			✓ 2	150	✓ 5	378	4	296		
	(For Mill No. 2.)											

Quality Soft steel. Promised to rush.

ORDER SYSTEM. FORM 1.

marked up, and also the number of core boxes for each pattern. The shipper's copy and the molding shop's copy are then detached when they are ready for filing respectively at shipper's desk and in the foundry file.

If when the order is entered on the books only a part of the patterns to apply thereon are in hand, that part of the order is tagged up and the order then sent to the shipper and to the molding shop. In this case, however, the party marking up the patterns fills in on form 2 those items which, for any reason, have not been tagged up, and he then retains this form on file until the patterns for such items have come to hand. It is desirable to have this form printed on paper of a different shade, or color, from the regular order form 1, so that the distinction may be more pronounced. If desired, space may be left in drawing up these forms for the insertion of pattern sketches to aid the shipper in identifying castings. It is best to have these

Order No. 7999
Cust. order 102-3/6

March 9th 190 3

Ship to 35th Street Mill,
Pittsburg, Pa.

Brown & Brown,
Pittsburg, Pa.

Via Wagon

	These Items not Tagged.	REASON.
12	Mill Carriages #1000	Pattern not received.
	Office,	
	Please phone B. &	B., this pattern is not here.
		Pattern Man,
		3/10/03.

Quality Soft steel. Promised to rush.

ORDER SYSTEM. FORM 2.

order forms printed on good heavy paper so that they will not be readily torn, or worn. The order forms No. 1 are consecutively numbered.

The memorandums made on forms 2 are destroyed when all patterns have been tagged and the data in column "Tagged" have been transferred to the two original copies.

In the pattern shed, where the patterns are marked up, there is fitted up a set of pigeon holes, of suitable size, alphabetically marked, in which all orders are filed until ready for the shipper and molding shop. For example, all orders from Brown Mfg. Co. and Brown and Brown are filed in pigeon hole "B," etc.

The molding shop's copies are filed alphabetically in a common letter file, or transfer case. Before the close of each day's work the office boy, or foundry clerk, goes from molder to molder, taking with him the file containing the molding shop orders, and checks on these orders the number of pieces molded on the various items, and the date.

The shipper's desk is also fitted with a set of pigeon holes in which his copies are alphabetically filed.

As the various castings are weighed up, the number of castings in each draft, and the weights, are inserted on the face of the order in the columns appearing on the right hand side of the order. Care must be taken to insert this data opposite the correct item. All orders covering castings which have been weighed up, ready for shipment, are filed by

themselves at the shipper's desk. The castings as they are weighed can be placed to one side, and properly marked, or they may be loaded at once for shipment.

As the castings are shipped the date is inserted at the top of the column in which the number and weight have been recorded. At this stage, suitable entry is made from these orders (before they are returned to the shipper's file) in the office blotters. The invoices are written from the blotters. As the record of these shipments is entered on the blotter, a suitable check mark (√) is placed directly over the figures giving the number of pieces shipped. The shipper's orders are filed in the office upon completion and the molding shop's copies destroyed.

If the number of the shipments made on an order is such that more space is required for recording same than is given on the face of the order, an extension piece may be permanently attached by mucilage to the right hand edge of the order and folded across the face of the original order.

A glance at the shipper's copy shown on form 1 tells us that the pattern for the first item of the order has not been tagged up for this order. A shipment of five spindles weighing 499 pounds was made on March 14th, and the check mark (√) shows that the shipment has been entered on the blotter. It also shows a shipment upon the last two items of the order on March 18th and 21st. Four coupling boxes are shown as having been weighed up but not shipped.

The advantages derived from the use of the forms and methods outlined above might be briefly stated as follows:

First. They give us a record at all times of just what patterns have been tagged and also when they were.

Second. The manager, or order clerk, by securing from the shop both of the copies of a specified order, or as it may be all the copies of all the unfilled orders from one customer, has at once a complete record of the condition of the orders in question. The copies of the orders can be secured from the works by the office boy, and the time of higher salaried parties materially saved. All copies are, of course, returned on the earliest possible moment to the files from which they were taken.

Third. The original records of shipments and weights are at all times at hand, marked upon the face of the order. The number of times this data is transferred is reduced to the minimum and costly errors thus avoided. This system relieves the shipper of a large amount of clerical work, as it is not necessary for him to make record in a book of each item as it is shipped, as this record is kept on the face of the order.

Fourth. Before the shipper's copy of order is filed away as completed, a glance over the face of same discloses any omission in entering on the blotter the record of each shipment. It is thus made impossible to ship any castings without charge being made for same against the customer.

The methods and forms as outlined above no doubt present several new features, yet it may be stated that they are in use in several large foundries and to the writer's knowledge are giving the most satisfactory results.

J. Byron Henry.

Molding Machine for Special Pipe Castings.

While the manufacture of cast iron water and gas pipe was one of the earliest branches of the foundry trade to become specialized, the molding of the necessary fittings has not until quite recently received any marked attention. Nearly every pipe foundry of any pretensions is generally divided into two departments, the pipe foundry proper, where laborers of a special class do the molding and core-making, and where the cost of this per ton of castings is very low, and, the general foundry, where all special castings are made, in which journeymen molders are employed. Hitherto this latter department has been conducted on the lines of a general jobbing foundry, but it now appears as if at least the greater part of its output will become specialized to a certain extent.

We show with this a plan and sectional view of a molding machine recently designed by Walter E. Stuart, of the Co-operative Foundry Co., Detroit, Mich., which has for its object the simplifying of molding special pipe castings, so that these may be turned out with greater accuracy and dispatch. With the Stuart machine a mold may be made in green sand, dry sand or loam, though with the larger class of castings the latter method will generally be found preferable, however many foundries have good success with dry sand molds for very large work. The machine under consideration is operated uniformly, no matter

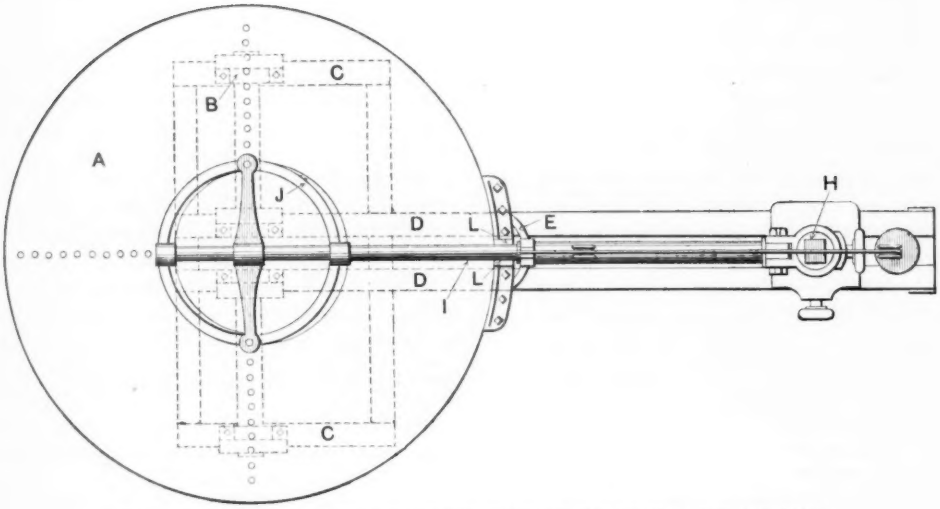


FIG. 1.—PLAN VIEW GF STUART MOLDIG MACHINE FOR SPECIAL PIPE CASTINGS.

which method of molding is adopted.

One feature of this form of machine molding is that the outlay for patterns and core boxes is reduced to the minimum, as only a short section of the pattern of the required diameter is necessary, this being drawn upwards as the molding progresses. The machine is provided with a tilting table A, swinging upon the shaft B and mounted upon the beams C and D. E is a hand wheel attached to the threaded shaft F, by means of which the table is tilted to the required angle. G is a support to assist in holding the table rigidly when the proper

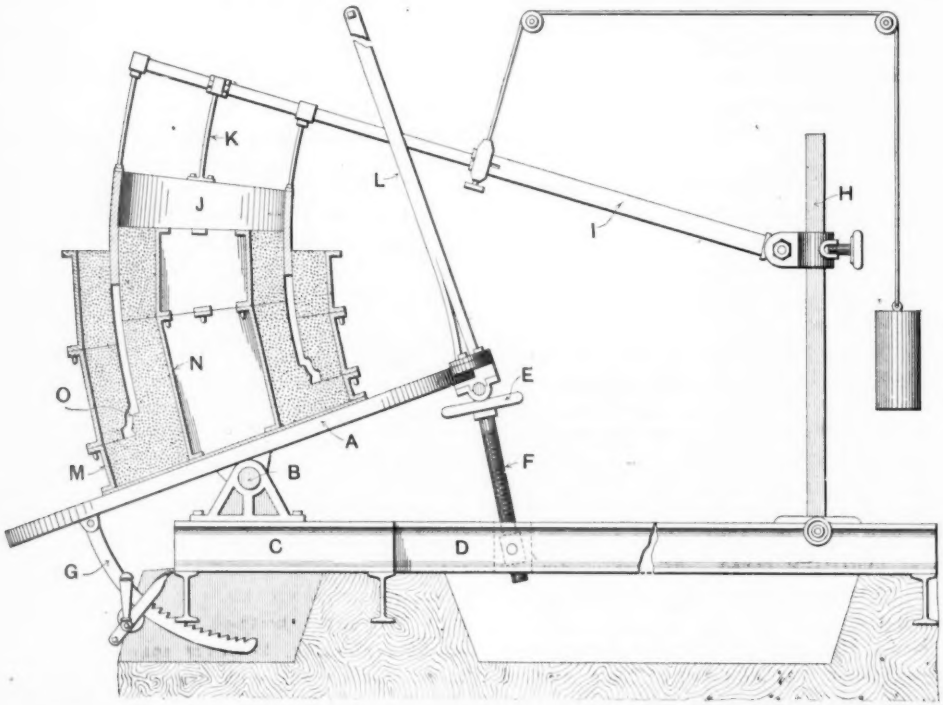


FIG. 2.—SECTIONAL ELEVATION OF STUART MOLDING MACHINE FOR SPECIAL PIPE CASTINGS.

angle has been determined. Upon the spindle H is mounted the adjustable radius arm I and to this is fastened the section of the pattern J through the supports K, which prevent tilting of the pattern and causes it to travel in a definite direction. To guard against lateral motion the upright guides L are provided.

As will be noted from the sectional illustration, showing the molding of a casting in dry sand, the flask is divided into suitable sections as is also the core barrel, around which the core is made. The core barrel is employed not only to give strength to the core, but also to save sand and labor in ramming up the core, as well as time in drying the mold. In making a mold a bottom plate is placed on the table A on which rests the drag section of the flask M and the lower section of the core barrel N. When the drag has been rammed up a joint is made and the pattern O, which forms the flange is placed in position and onto this is lowered the sectional pattern J. The next part of the flask can now be lowered onto the drag and as the making of the mold progresses other parts are added until the mold has the required length. The illustration shows joints made at each section of the flask and core barrel to facilitate handling in the drying ovens or on the floor. It is evident that both flasks and core barrels may be divided up as best suits the shop and that several sections of the flask may be fastened together and treated as one unit, if facilities for drying and handling the mold permit this.

The Future of the Foundry Industry.*

BY RICHARD MOLDENKE.

But little thought is given to the future of our industry in these brisk times of orders in plenty. Our plants are yet crowded to their full capacity. Enlargements have been the rule up to now, but the projection of new enterprises has practically ceased, the only possible exception being in connection with established plants. This, then, seems the time to analyze the conditions which will affect the future of the foundry industry to a greater or less extent.

In general we may say that specialization has become the order of the day. At the present time at least three quarters of the foundry output goes into channels within fixed and narrow bounds. This condition is not only likely to continue, but will become the national trade necessity. Specialization as against generalization is the sharp contrast we note in comparing our industrial system with that of Europe. Every one following out his own line of production to the extreme, learns the fine points which enable him to undersell at a profit. With our natural resources and transportation facilities, it is easy to see that careful nursing of the foreign trade we now enjoy, should do much to mitigate the disasters of the hard times to come.

Looking over the likely condition of the money market, it seems as if competition for work will sharpen considerably. Founders who have made connections which secure them preferences in the way of holding work will be compelled to drop prices in spite of this, the outsider naturally leading the procession. Every founder will therefore try to get hold of something he can do better and cheaper than his fellow-townsman. Some will succeed in this and keep their identity intact. The stronger ones will, however, be gradually drawn into working agreements with others in their line. From this actual combination is but a short step. This tendency, which has made our present time one of huge industrial combination, will be still more accentuated in the future. Self-defense will compel closer business relations so far as it affects the buying of materials from the great combination of other industries, and similarly the selling to the great combinations of still other industries. With these conditions properly balanced, and sufficient "independents" to make things interesting, there is not the same chance of extreme disasters in our industrial economy as heretofore.

We may therefore look for combinations in the heavy lines of foundry work, such as in car wheels, ingot molds, rolls, malleables, stoves and radiators, electrical work, and special lines of machinery. We already have working agreements, small combinations, and plans for larger ones in our industry. The tendency is therefore plain enough to see, and it will result in material changes in the actual operation of the plants.

We are undoubtedly going to face serious times with our labor conditions. Were only the interests of the foundry at stake we might feel as if we are suffering for the good of the

*From a paper read by the author before the New England Foundrymen's Association.

country. Unfortunately, however, the whole industrial system of the nation is bound to meet a crisis which will be delayed or hastened by conditions which may well give us grave concern. We are daily seeing the breach between employer and employe growing wider, and this in spite of all that is done to bridge the chasm. Organizations which should naturally work in harmony are really formed to intensify the difficulty, and as between organized labor and organized capital, the crisis through which England has passed and lost its industrial supremacy, now faces us, and will next confront our chief competitor—Germany. Now what may the future have in store for us herein?

All signs point to the will of the people, that power, whether in the hands of grasping corporations, or in large groups of workingmen, shall be coupled with responsibility. Imagine an industrial association wronging any one laborer without being sharply brought to account and mulcted heavy damages, and rightly so. When, however, an employer is all but ruined by tactics which are invariably denied but are practiced just the same by individual members of labor associations, he has the choice to fight or go under. Common justice demands that the parties of both parts be held liable to damages, and be made to obey the law without discrimination. The unscrupulous employer is just as much a menace to the country as the professional labor agitator.

We will therefore see the compulsory incorporation of organizations which aim to regulate the status of labor, and thus the "right of might" will be whipped into subjection to the highest welfare of the state. This may take some time, but it is sure to come. Our national organizations of foundry capital and foundry labor—yes, even the local ones eventually, will be made responsible. Injury to the vested interests of our founders as well as breach of contract with the men will be punishable, and eventually be of rare occurrence.

Then—and only then—will the real value of organized effort appear. And that is in the education of its constituent members. A labor union which instead of drawing up grievances and nominating shop committees, will teach its members to become more valuable to their employers, is a positive blessing to the country at large. An organization of employers which need not scheme how to circumvent impending demands and provide means to check violence and outrage to simple constitutional rights, would be a monument to the efficacy of our civic administration. Could the same effort and time be expended in improving conditions for labor in the foundry, another and most telling benefit would redound to our coveted permanent industrial supremacy. And I predict that all this will come, in time, for it is the consequence of enlightenment and education. Only in this way will the moral wrongs of our industrial system be righted.

This brings us to another phase of the foundry labor question, and one which is more closely identified with the actual operating, the general aspect of the labor question being rather a matter of policy and finally an added expense to the buying public. The eight hour day has long been demanded, and I predict that it will come. Whether it will bring disaster to our industry, or will find us prepared to balance matters by suitable changes in our running methods, may well be worth our careful attention.

Personally, I favor the eight hour day, but—we must have three of these short days in every twenty-four hours. The wise king, who held that eight hours were for work, eight for sleep, and eight for recreation, was perfectly right. It took many centuries to come near his ideal, but it will not be many more years before this is attained. However, if labor is to receive high returns for short hours, capital is no less to take as heavy an income as these highly paid short hours can be made to yield. When I say that capital invested in the foundry should yield interest for twenty-two and a half hours out of the twenty-four, nearly every foundryman will throw up his hands and say, impossible! And yet this is exactly what many of them will have to arrange for or go out of business.

Do you note the general inquiry with reference to running the cupola continuously? You may not be aware that many foundries are already running two shifts and could easily arrange for three if there were molders enough available. The arbitrary arrangement of the apprentice question is bound to take a fall in the near future, and molders, good ones and plenty, will take work where it is offered. The solution of the whole future of the foundry lies in the molding machine and men with better all-around foundry education.

Probably nine founders out of ten will tell you that night work is no good. I have never found this to be the case, but always enjoyed the sight of floor upon floor of molds ready to

pour the first thing in the morning. With plants as light at night as in the daytime, with proper organization, and short hours instead of the usual eleven hour night shifts, wonders of work can be accomplished.

One of the chief interferences with effective night work is the objection that molders on four or five day molding jobs have to letting others continue their operations. Suppose now, that the half dozen men who would be involved were given a contract to turn out the job properly, this difficulty would fall away at once, for no one has yet seen competent and friendly molders refuse to pound sand together on the same mold. The only other objection of account we meet—that molders want to pour their own molds—is cared for by continuous pouring.

Now I predict that something along these lines will come sooner or later, and if the foundry industry, which is looking very closely into the recent experiments with double turns, is sufficiently alert, the coming eight hour day need not be feared very much.

Perhaps the last thing to touch upon, and yet the one matter which we will meet first, is the future development of the foundry equipment. This would form a topic upon which discussions may be held by the hour. Suffice it to point out two things. The molding machine, and conveyors. Everything else, as well as these, is wrapped up in the policy the foundry will be forced to adopt in the near future. I have outlined this policy, as I see it, in what has gone before, and need therefore add but little. Specialization means the molding machine with a vengeance. Consolidation gives the sinews of war to adapt, adopt, and force their systematic use. The breaking up of restrictions regarding apprentices means more and better men to do the other molding. Conveying systems mean the systematic production of castings, outside of the molding end, at minimum cost. Continuous molding, pouring, and in fact continuous work in the foundry based upon short hours with good pay, means getting the best efforts of the men, contented men, and a prosperous country. Naturally the study of the foundry in all its details will not cease. Standardization, improved work, uniform customs, we might say—the millennium, minus the human end, which we will never fully control or correct; all things which help to make foundrymen reasonably content with their life work—all this lies in the future for us.

Definitions of Different Classes of Pig Iron.

Bessemer pig iron (below 0.10 per cent phosphorus) is made into steel in a Bessemer converter, the carbon and silicon being removed as gases by blowing cold air through the molten pig iron. The percentage of phosphorus and sulphur in Bessemer pig iron must be very low, as neither is removed in the conversion of the iron into steel.

Low-phosphorus iron (below 0.04 per cent phosphorus), is almost entirely used by acid open-hearth steel works in the manufacture of steel castings and special grades of plates and forgings.

Basic-pig iron (below 1 per cent phosphorus) is made into steel in a basic open-hearth furnace. The silicon and sulphur should be very low.

Foundry pig iron is usually remelted in a cupola and made into castings. It contains about 93 per cent of iron, from 3 to 4 per cent of carbon, from 1.50 to 3 per cent of silicon, from 0.50 to 1 per cent of phosphorus, and from 0.20 to 1.50 per cent of manganese. The desired percentage of these ingredients varies according to the character of the castings to be made.

Forge or mill iron is used in puddling furnaces for making wrought iron. The carbon, silicon, phosphorus, and sulphur are largely removed, and the purified iron balls rolled into muck bar, this in turn being piled and rolled into finished bars.

Both white and mottled pig iron are used in puddling furnaces, and to some extent in foundry mixtures. Their chemical composition varies between wide limits.

Ferrosilicon is largely used by manufacturers of open-hearth steel castings. It usually contains from 10 to 20 per cent of silicon and is low in phosphorus.

Spiegeleisen is used chiefly by manufacturers of Bessemer steel. It contains, as a rule, from 9 to 21 per cent of manganese and is low in silicon and phosphorus.

Ferromanganese is used by Bessemer and by basic and acid open-hearth steel works. It contains from 45 to 82 per cent of manganese, although 80 per cent ferromanganese is considered the standard. It is low in silicon and phosphorus, but higher in carbon than pig iron.

Charles H. Lawton and John R. Logan, of Wabash, Ind., have incorporated the Lawton Mfg. Co. with a capital stock of $50,000.

The Cross System of Molding.

A patent has recently been issued by Edwin Cross, of Burnham, Pa., covering a method of securing a large output from a single molding machine. The inventor claims that under present systems of working molding machines they are not kept in operation more than a fraction of the time, the balance being occupied in preparing the molds for ramming, while in the method proposed by Mr. Cross a number of men may be kept busy at one time performing this labor without interfering with one another, and the machine will be in operation ramming the molds almost continually. It is also expected that this method will develop a higher efficiency among the operators, as each will have only a certain share of the work connected with the making of a mold to perform.

Figs. 1 and 2 are plan and sectional views of the arrangement proposed by Mr. Cross. In operation a start is made at the point *C*, where the matchplate and flask are mounted on a truck and pushed to *D*, where the first molder distributes the required amount of facing sand over the pattern. The carriage is then shoved to *E*, where the flask is filled with ordinary molding sand and transferred to *F* to receive the ramming board, when the whole goes to the power rammer at *A*, leaving this in due course for the point *B*, where the bottom plate is fastened to the flask and the mold removed by a rapid acting crane, when the matchplate is made ready for the next mold. To avoid inconvenience through the sand spilled during

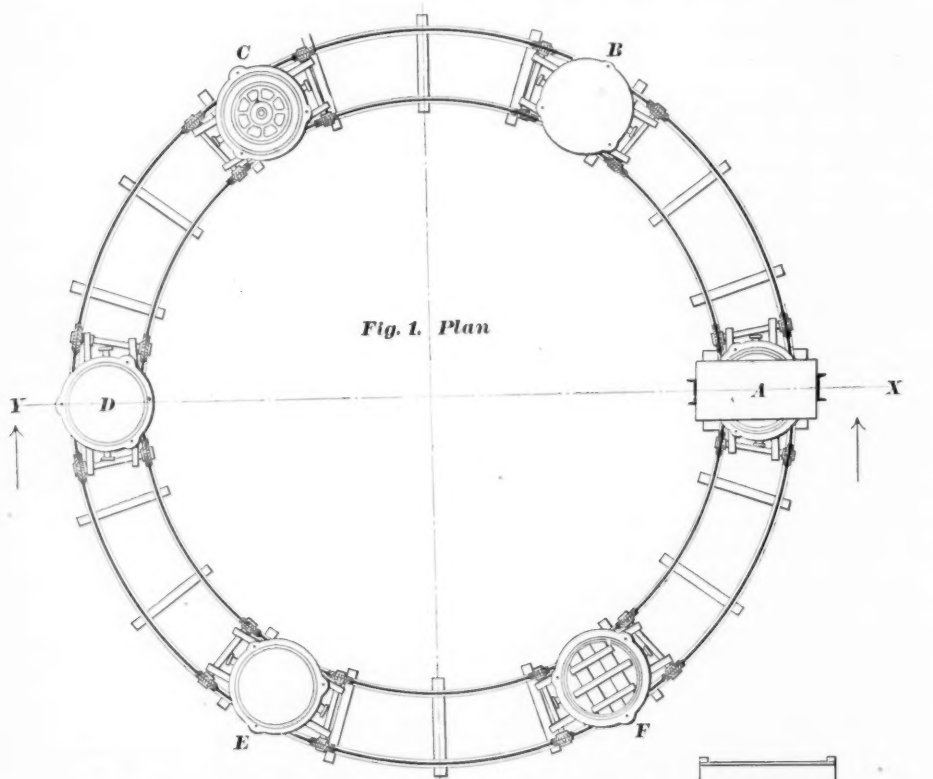


Fig. 1. Plan

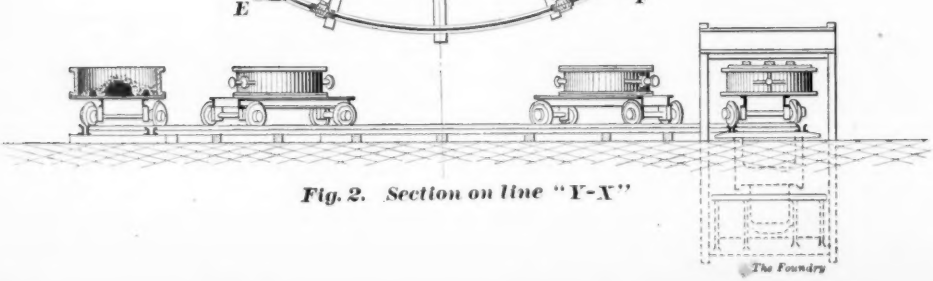
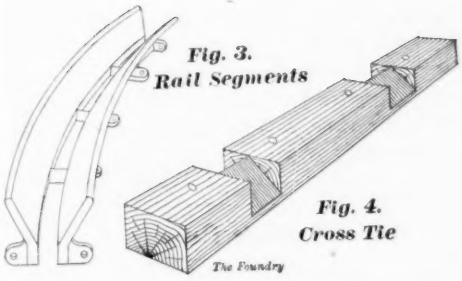


Fig. 2. Section on line "Y-X"



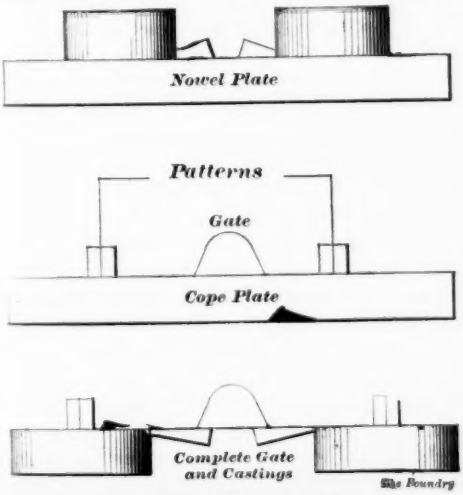
the different operations a special track, a segment of which is shown in Fig. 3, is provided, as well as the cross tie, Fig. 4.

Gating Machine Molds.

With the advent of the molding machine's entrance into the foundry there has come the question of gating the patterns to be mounted thereon in such a way as to do away with dirty castings, due to inexperienced help. The average molding machine operative, as a beginner, knows nothing of gating a casting or string of patterns, whichever the case may be, or of pouring a mold, consequently many castings are lost.

This can be partly remedied at the start by having the pattern maker, who fits up the machines, adhere to a set rule in forming the runners and gates, and from my experience this is the best method of saving castings, where the iron runs dirty and varies in temperature, as is very often the case when castings are lost day after day through apparently unexplainable causes.

The helper in pouring his molds does not wait to skim his ladle, but pours the iron as he finds it, hot or cold, and each mold takes in a quantity of dirt with the iron. The sketches appended show a gate I have used with success and find it generally applicable. It does not vary in principle from many gates used in malleable shops, although but few would apply it to gray iron as I have done, for this seems at first unnecessary. The heavy cope gate not only catches the dirt but acts as a feeder to the castings and helps to overcome shrink holes. It is also somewhat of a protection against the evils of spasmodic pouring. In the illustration the gate is shown as applied to patterns mounted on match plates, two of which are necessary to form a mold. In adopting a standard width cope gate, one cope board can be used for many flat back patterns. The lower sketch in the illustration shows the gate and casting as these leave the sand, the casting in this instance being an ordinary pipe plug.



GATING MACHINE MOLDS.

Gates of this kind will be found to break off clean and the dirt will invariably be found in the extreme top portion of the cope gate. If one is having trouble with machine made castings, large or small, it will pay him to give this gate a fair trial. I have used it with success on small work and even on castings running well up to the ton, when made on stripping plate machines. Molders will say that it requires judgment to gate each piece properly, and so it does, and it will pay every foundry to give some attention to its laborers and piece workers which will tend to increase the quality of their output.

JOHN W. GRAHAM.

Cost Keeping In Foundries.

I was greatly interested in Mr. Kirk's article in the April *Foundry*, criticizing a contribution of mine in the March number. In going over his article I have come to the conclusion that I did not give a clear enough description of my method of cost keeping, as I do not believe Mr. Kirk understood the system I described when he wrote his letter. The blank forms without the actual items entered on them are no doubt misleading. We do not use the hours column on the molders' card. These cards were printed in large quantity, and as this column was found to be of no value, we dropped it altogether, but kept on using the same cards as a matter of economy. The same applies to the weight column. These cards are

simply made out to get the amount of work put up each day by each molder in order to make up the production sheet. A book such as Mr. Kirk illustrates would answer as well, but we find the cards more convenient. The cleaning room hands do not make out cards, their time being recorded on a time recorder the same as the rest of the employes. A clerk is sent out each day to make an accurate count of the castings of the previous day's heat, and to insure accuracy, another clerk checks the count of the first one. This is the plan we have always followed, and is exactly in line with Mr. Kirk's suggestion.

Form 3 is made out by the timekeeper each day as a matter of convenience to the writer in making up the total cost as given on Form 5. It gives the total amount of labor each day, and is much more convenient than a book. Form 4 is the report given in each day from the foundry, showing the amount of iron and other material used, and is strictly accurate, as all material is carefully weighed, and no "guess work" enters into its composition Other material of such kind as can be kept in the store room is issued on requisitions, and is also kept accurate. The records we keep of material check very closely with the amounts shown at the regular stock taking, and this shows that the reports of material must be correct.

In regard to the cost of our iron mixture, this is shown on the cost card, Form 5, and it is therefore not necessary to have this appear on the foundry report. In this connection, however, I will say that this is a subject of much interest to me, as it doubtless is to others, and I would like very much to have Mr. Kirk give his method of figuring cupola reports through the columns of *The Foundry*, as I would be grateful for any new suggestions he would offer. The cost card shows this report according to our method of figuring it, and also shows all other items of expense for the day, and I therefore think that Mr. Kirk is putting it a little strong when he says that nothing is learned from these reports. There are no statements of costs, everything which cannot be gotten from the daily reports, such as the cost of fuel (we use natural gas), office and general expense interest, etc., being carefully averaged through a certain period. I believe as I mentioned above that Mr. Kirk has misunderstood my former article, and I trust that this will make it clearer. In regard to the accuracy of the system I would say that after taking stock and closing our books last year the statement shown by the books and that shown by this system of reports were almost the same, as I will gladly prove to any one interested at any time.

R. W. MACDOWELL.

Duplicate Flasks.

Many foundries are often not well supplied with flasks for small castings and it is a common occurrence to see a small casting made in the floor, with any old thing resembling a flask being used for a cope, four or more stakes driven into the ground serving as guides to locate it in its position on the drag part of the mold. Another not uncommon feature is to observe in a foundry yard a number of flask parts jammed tightly together. These are usually misfits, which the molder has made an attempt to pair, the result being to jam the cope on the flask pins to such an extent that one of a pair is often broken in trying to separate them.

Foundries using such appliances cannot compete successfully with well equipped shops, in which all flasks of the same size are duplicates one with the other. Not only is the molder enabled to put up a larger amount of work, but the quality is usually much improved. The ordinary sand match is generally used for small orders, while the plaster match is used where regular quantities of castings are required. If the order is of sufficient size and large enough to warrant the expense, the patterns may be placed on a match plate or fitted up for machine molding. Duplicate flasks suit all conditions of molding, whether for one casting or for one thousand, or for any quantity which may be wanted at any time.

Where all flasks of a size fit each other there is no waste of time in finding pairs, and no damage need to result from misfits, and the molder can get to work as soon as the pattern is handed in and will then be doing actual molding. Very often the day's output is curtailed through the molder not having flasks enough to last him through the day, while this never happens where there are plenty of duplicate flasks. Metal patterns should always be kept of different sizes of flasks used so that when any parts are broken they may be readily replaced. These flask patterns should be carefully filed up and fitted so that castings, as they come from the foundry, may be used with the minimum amount of fitting.

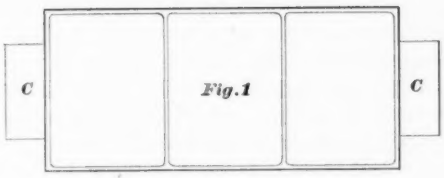


Fig. 1

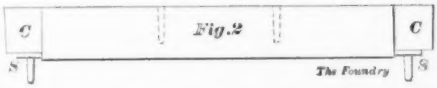


Fig. 2

Figures 1 and 2 are plan and side views of an iron flask pattern in which it will be noted that both pins and holes, as well as handles, are located at each end of the flask instead of being distributed over both ends and sides. Another method not generally employed is to mold the pin part, as shown in side view, with the pin downwards. The parts marked C are prints for cores, which contain the handle and also cover the lugs "S." When molding these flask parts the pattern may be either carefully bedded into the floor or rammed up in a suitable drag, care being taken that the sand is firmly rammed around the pins. When the pattern has been carefully rapped and drawn, turned pins are dropped into the pin hole impressions in the mold. These pins should just fill the hole exactly and when set in their respective places should leave no clearance. To obtain this result it is necessary that the pins which are fitted into the iron pattern should be 1-32 of an inch smaller than those which

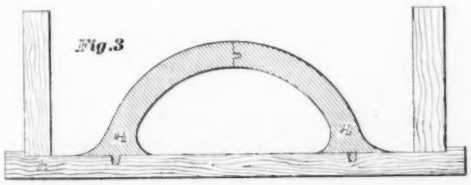


Fig. 3 Fig. 4

are in actual use on the flasks. The rapping of the pattern will make up for this difference in the size of the pins. The handle cores are made in a core box, as shown in Fig. 3, the box being rammed up in the position shown, turned over and the bottom of the core box B removed when the handles H may be rapped a little and easily twisted out of the core. This form of a flask handle is very convenient for the smaller sizes of flasks, is easily and quickly made and requires but very little fitting up after the casting is made

Before fitting up these flasks parts the steel template, Fig. 4, is tried over the pins to see that these are in their proper position. If the molder has been careless or the metal is of unusual shrinkage the template will not fit as it should and the parts found to be defective from this condition are thrown on the scrap heap at once. However, with fair and careful molding and the molds poured with a uniform grade of iron no trouble need to be anticipated. The writer has in use about 2,000 flasks made after this manner in sizes from 8x8 inches to 2 feet by 2 feet square and in groups of 50 to 100 of each size. In no instance has there been great variations. The pins are similar to that shown in sketch, Fig. 5, and are readily turned out. It will be noted that the pins used for each end of the flask are of a different size.

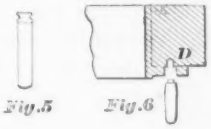


Fig. 5 Fig. 6

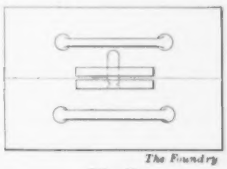


Fig. 7

This is done to prevent the flask from being closed end for end, which may easily happen, especially where these are employed on molding machines and one part being used on each machine. When molding the drag part of these flasks the pins are removed from the flask pattern, as shown in Fig. 6, and the threaded hole D filled up with wax. Fig. 7 is an end view of a two-parted flask showing the position of the pins and handles. When thus placed the flasks are much more convenient to handle in turning them over. The molds may also be placed much closer together than would otherwise be the case, thus economizing space.

GEO. BUCHANAN.

J. Lavelle & Son, of Anderson, Ind., have had plans prepared for a $15,000 iron and brass foundry. The main building will be 40x100 feet.

The Sterlingworth Railway Supply Co., Easton, Pa., have plans completed for additions to their malleable department, increasing its present capacity some 5,000 tons per annum.

Smalley Bros. & Co., of Bay City, Mich., will build a new foundry, 50x125 feet.

The Chicago Heights Malleable Iron Co., Chicago Heights, Ill., has begun work on its new plant. The main foundry is to be 80x350 feet.

The Farwell Stool Plate Molding Machine.

We give below an illustration of the Farwell stool plate molding machine made by the Adams Co., Dubuque, Iowa, which is designed especially for stripping plate work where stooling becomes necessary. In this machine the pattern at all times rests upon the rigid frame of the machine, giving a solid foundation to all parts that are subject to strain when the sand of the mold is being compressed, instead of supporting these by cranks and connecting rods. In the ordinary stripping plate molding machine it has been found impracticable to press the sand where the patterns have been supported by toggle joints, as these are subject to wear and will spring under the pressure exerted when a mold is being rammed or pressed by mechanical means, although this will not occur when using hand rammers. In the Farwell machine the stripping plate is raised, thus stripping the pattern.

The stool plate takes care of the stooled parts of the stripping plate or parts which are isolated from the main plate, as, for instance, the hole in the hub of a wheel or the parts lying between the spokes. To make a closer fit babbitt metal is used where the stripping plate meets the pattern. The machine shown will take flasks up to 18x24 inches in size.

Recent Patents.

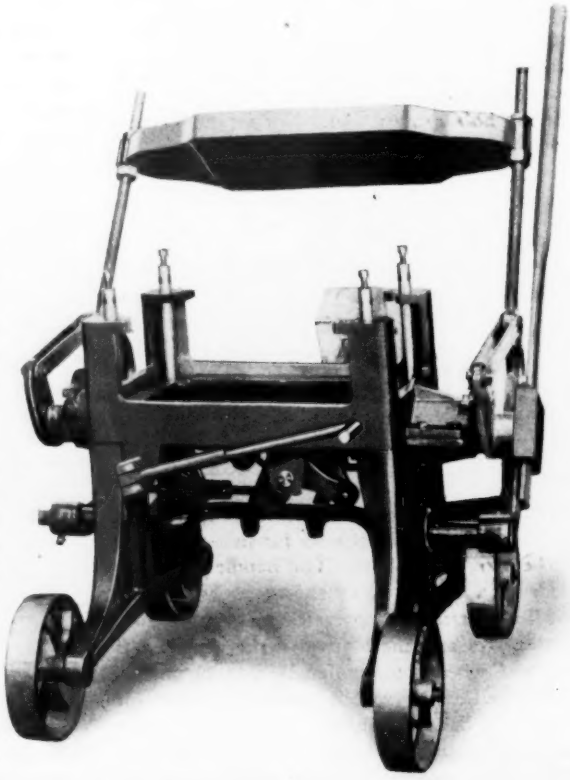
Joseph L. Stuart has assigned his patent No. 701,772, to The Lobdell Car Wheel Co., of Wilmington, Del. This covers a molding machine which is so designed that the mold may be readily placed in position underneath the rammer head and the proper pressure applied.

Herbert H. Franklin, of Syracuse, N. Y., manufacturer of "Finished Castings," has patented another form of mold No. 702,194. This is an improvement on his old devices, which embodied a metal mold above a melting pot provided with a plunger for forcing the metal up into the mold under pressure. In this instance the improvement lies in separating the parts of the mold slightly about .003 inches, to facilitate the escape of air during the entrance of the molten metal. Mr. Franklin is also the owner of the Underwood patents on this type of machine, the latest of which was granted Dec. 9th, 1902, No. 715,713.

The South Bend Iron Works, South Bend, Ind., owns the patents No. 702,928 and No. 707,397, obtained by Calvin R. Davis for a method of making pattern plates and mounting the pattern thereon.

L. S. Stiles, of Philadelphia, has improved his pneumatic rammer, and has therefore been granted patent No. 703,013. This belongs to the reversible type of rammers, in which a peen is carried on one end and a butt rammer on the other. In this instance devices are provided for locking it in either position and a special valve gear is also included.

Patent No. 703,034, granted to William C. Wright and assigned by him to the Draper Co., of Hopedale, Mass., is one of a series previously referred to, designed for use with the vibrator molding machines. The pattern gate and vibrator extension are supported wholly by the match, the match frame having a recessed portion through



THE FARWELL STOOL PLATE MOLDING MACHINE.

which the extension passes without coming in contact therewith.

Frederick Baldt, Sr., of Chester, Pa., has taken out four patents, Nos. 703,169, 703,170, 703,171 and 703,172, on processes of molding chains and light steel castings. They all relate to the application of the old *cire perdue* process to this branch of the trade. A master mold is first formed and fusible patterns made by pouring a fusible material into this mold. After being removed from the master mold the pattern may be covered with sand and rammed up in a mold, and as the pattern does not have to be handled or disturbed in any way, the mold is seamless since the pattern is removed by heating it until it melts. This method is said to be of extensive value in casting chain, as the patterns may be easily linked together before the mold is being formed. Of course each link must have a separate gate.

James J. McClelland, of London, has designed a molding machine, No. 704,078 which consists of a strongly built frame carrying the rammer which may be worked by any ordinary power. A flask carriage is provided for transferring the molds to the rammer, and arrangements are made whereby the flask may be lifted from the pattern and a vibrator employed.

M. M. Duncan, of Alton, Ill., has assigned his patent, No. 704,712, to James Duncan. This covers a sort of a "Rock-Over" machine in which the flask, pattern drawing device, etc., are mounted on a counterweighted rocking shaft. After the mold is formed the flask is inverted and the pattern drawn downward by means of a screw arrangement.

Stephen Jarvis Adams, the veteran inventor of molding machines, has, after eight years, secured patents on his most elaborate design, and the process of molding connected therewith, which he has assigned to Marcelline C. Adams, Nos. 704,951 and 704,952. Instead of making the mold and splitting this into two parts, Mr. Adams gives to each side of the mold an impression corresponding to the shape of the pattern. These are then placed face to back and a number assembled which have to be poured at one time. A similar method of molding plowshares in vogue at the plant of B. F. Avery & Sons, Louisville, Ky., was described in our issue of January, 1898, page 203.

J. R. Davies, of Waukegan, Ill., has been granted patent No. 705,215, on a machine in which the main object sought is to so compress the mold as to give uniform density to all parts thereof, and for this purpose fluid pressure is employed.

Patent No. 706,487 is granted to J. N. Battenfeld for the "New Era" molding machine, which is manufactured by The Cleveland Automatic Machine Co., Cleveland, O. With this machine all the operator has to do is to place the flask thereon and remove this when the machine stops.

Charles Herman, of Allegheny, Pa., has made further improvements in his "Jarring" molding machine, for which he has been allowed patent No. 706,751.

J. P. Appleby, of Hopkins, Minn., has made some improvements relating to ordinary stripping plate machines, for which he has received patent No. 707,535.

E. E. Punzelt has assigned his patent, No. 711,072, for a molding machine, to Walter Perry, of Ansonia, Conn.

Among the latest molding machines patented by the Draper Co., of Hopedale, Mass., are the inventions of John Anderson and C. M. Day, patents Nos. 713,047 and 714,285. These are especially adapted for large, intricate patterns.

A German idea of making pipe molds is covered by patent No. 705,378, granted to Franz Burgers.

Edmund Weidenbaker, of Chicago, Ill., has designed a jacket or shifting box for snap molds, patent No. 709,569. This is adjustable in length and width, so that it may be used for different sizes of molds. This is accomplished by dividing the sides and ends and providing slotted extension pieces.

A. S. Hodges, of Everett, Mass., has remodeled his sash weight flask which has been used for several years, patent No. 709,768. He has added a false mold board and made it adjustable to different sizes of castings.

The invention of F. Lips, of Arlington Heights, Ill., No. 714,207, relates to a hinged flask and the method of locking this into position.

James Mills, of Wilmington, Del., has been granted patent No. 710,331, on a cope especially for use on molding machines.

The method of casting end pieces onto radiator sections, made from wrought iron

pipe, is the subject of patent No. 709,925, granted to Charles Phelps, of Oskaloosa, Ia.

J. P. McCoy and W. V. Lukens, of Philadelphia, have been awarded patent No. 713,571, on an improved chaplet.

G. H. Dickerson and J. M. Gordon, of Columbus, Ind., have devised a method of molding spoke wheels for which they have been granted patent No. 707,213.

John C. Reed, of Allegheny, Pa., has been granted two patents, Nos. 703,740 and 715,293, on improvements in molding bath tubs.

Thomas Griffith, of Cincinnati, O., has patented a portable core oven, No. 705,665.

Alfred M. Hewlett, of Kewanee, Ill., has been awarded two patents, Nos. 712,532 and 712,533, on a core drying process and apparatus.

The Pratt & Letchworth Co., of Buffalo, N. Y., have purchased the rights to patent No. 715,964, recently issued to Bradley and Gilbert on a molding machine. This has a vertically movable mold table, above which is arranged a swinging frame carrier, a press head and a combined mechanical rapper and pattern drawing device.

S. H. Stupakoff has received patents No. 716,957 and 716,958 for methods relating to the mounting and drawing of patterns. These were the subject of papers read by the inventor at the Boston meeting of the A. F. A. and have already been described in our columns.

G. G. Howe, of Indianapolis, has designed a molding machine for which he has been granted patent No. 717,577. This consists of a rotating circular table adopted to carry a series of snap flasks and matches. During their passage on the table the molds receive attention at the hands of operators stationed at different parts, a cope and a drag being made complete during each revolution.

Another machine of this type, but more complete in its detail and intended to work largely automatically, has been invented by J. A. Field of Dunkirk, N. Y. It is an improvement over other machines designed by him and Orrin Bryant several years ago for molding radiator sections.

The Warren Foundry & Machine Co., of Phillipsburg, N. J., is the assignee of the pipe molding machine invented by J. Ingham and others, patent No. 718,254. The ramming device is operated by electro-magnets and arrangements are made for supplying the necessary sand through a proper conveyor.

The latest patent for a collapsible core barrel has been granted Chas. E. Crosby and Emil C. Aurin, No. 718,700. This consists of a number of segments so arranged that they may be folded together and thus be easily removed from the casting.

An apparatus for molding double arm pulleys has been devised by Solomon Shaw, of Milwaukee. The chief points covered by this are core arbors for carrying the center core between the two sets of arms.

G. A. Johnson, of St. Charles, Ill., has invented a device for setting small cores, patent No. 716,237. This is placed over the mold in the proper position, when a cylinder carrying the cores is rotated to deposit these in their proper places.

The Crane Co., of Chicago, has purchased W. W. Doolittle's molding machine patent No. 718,829. This has a special vibrator pattern drawing device.

The Melting Ratio.*

BY JAMES A. MURPHY.

Many foundrymen have fallen into the habit of talking high melting ratios to such an extent that the more inexperienced proprietors are led to think that their foremen are simply robbing them, when one to six or seven is the rule in their establishment. And yet a better ratio may be impossible to obtain when certain classes of work are to be gotten out properly. I do not believe in saving coke at the expense of castings, but this is just what many foundrymen are doing, and many more have done.

A few years ago I saw the efforts of the superintendent of a large eastern foundry to melt at one to ten, with the natural failure that resulted for the particular class of work he had in hand. During two months of this trial, three steam cylinders weighing over 20 tons each, not to mention many tons of the smaller castings, were thrown out by the machine shop. All this work was lost because of dull iron. There were also many tons lost in the foundry which never passed the drop.

Now there is no doubt at all that iron can be melted at the ratio of one to ten, *for certain kinds of castings*, and when anyone speaks of melting iron thus, it would be well to pin him down to facts, to ask him whether the coke and iron was accurately weighed, what the height of his tuyeres is from the cupola bottom, the

*From the *Journal* of the American Foundrymen's Association.

height of charging door, diameter of cupola, and blast pressure, what percentage of pig iron, scrap or steel goes in, whether the pig and scrap were large or of normal sizes, whether coal was used with the coke, and the quality of each. Finally what was the class of work to be poured and the length of time necessary to accumulate enough metal to pour the pieces.

Information of this sort would be useful in making comparisons, even though conditions are seldom alike in any two foundries. One establishment may have a cupola of an improved type while the other would be struggling along with the old time home-made affair. I have on some occasions melted iron cheaper in the air furnace than in the cupola, but it would be folly to assert that the air furnace process in the cheapest. Extra good conditions governing a "heat" in the air furnace or cupola are no criterion by which to judge or guide others.

Here is a heat of 16¼ tons taken off under pretty favorable conditions. The coke was excellent and the pig iron and scrap of normal size. In the first three charges there were 35 per cent steel clippings, the other charges ran 50 per cent pig and 50 per cent scrap. The height of the tuyeres from under side of sand bottom 14". Height of charging door 9 feet, pressure 10 oz. Bed of coke 700 pounds. First charge 2,500 pounds iron and 200 pounds coke. Each succeeding charge had 2,000 pounds iron until the last, when 100 pounds coke only was used. This was in the summer of 1901.

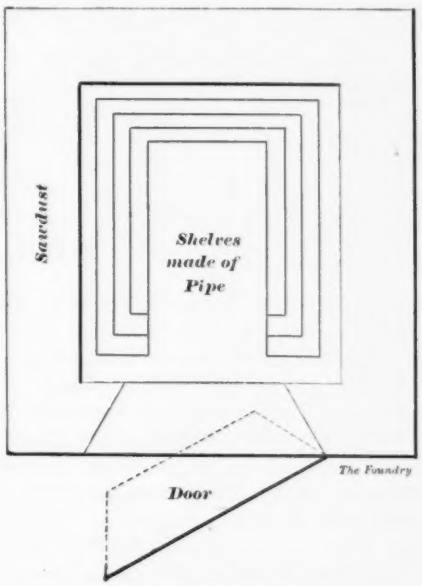
During the greater part of 1902, I could not melt a ten-ton heat better than one to seven and eight-tenths, and smaller heats often down to five and three-quarters. This was a great reduction from one to nine as shown in the first example mentioned, but the quality of the fuel was responsible for this. Had I kept up my melting ratio, I would have lost many castings, and as these were engine and other particular castings, they had to be sound and perfect in every detail.

I am a firm advocate of economy in our foundries, but believe that in many instances the saving of fuel to give higher melting ratios, is equivalent to saving a gill at the spigot and losing a gallon at the bung-hole.

The Taylor-Forbes Co., Guelph, Ont., will build a large addition to their iron foundry to be 390x60 feet, and will also erect a malleable iron foundry 200x70 feet. The cost of both to be about $45,000.

Steam Heated Core Ovens.

In my opinion the steam heated core oven is the best as well as the cheapest, as it never burns or scorches the cores and dries these quicker than ovens using either coke or coal for a fuel. The oven I use is built of common coarse matched boards, practically after the fashion one would construct an icehouse, only that it has a double roof over head as well as the sides. The space is six inches in thickness and is packed with sawdust. The door is constructed on the same principle.



STEAM HEATED CORE OVEN.

The shelves are formed of 1¼ inch steam pipe, using four strands to each shelf, arranged somewhat after the fashion shown in the attached sketch. Larger or smaller pipes may of course be used and the distance between the shelves can be suited to the class of cores which are to be dried. The oven we have in use is built 6 feet high and dries all the cores turned out by fourteen core makers. Direct or waste steam or both may be used.

PATRICK SHIELDS.

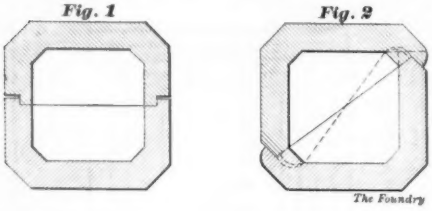
The Beloit Iron Works, Beloit, Wis., are extending their foundry and pattern shop.

The Litchfield Foundry & Machine Co., of Litchfield, Ill., is preparing plans for additions to its plant.

The Valentine Engineering Co. is having plans prepared for a foundry and machine shop to be erected at Eddystone, Pa.

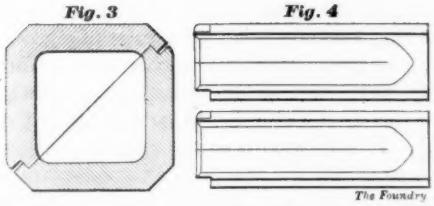
A New Form of Ingot Mold.

While ingot molds for Bessemer and open-hearth castings are simply square, slightly tapering, tubes with bottoms in a separate casting and removed from the ingot by drawing them off endwise; the smaller ingot molds for crucible steel castings have generally been made in separable halves usually parted flatwise, tongued and grooved together, with a bottom cast in each half and removable by opening off the mold. See Fig. 1. As the two halves have to be cast from different patterns and planed separately, it is quite difficult and practically



impossible under ordinary conditions to keep the patterns from warping and so to conduct the planing that the two halves will match accurately, the result being that the ingots cast in such molds are more or less uneven on the sides and show fins. The presence of these fins renders it necessary to do considerable chipping to prevent seams and streaks in the finished product.

Some fifteen years ago ingot molds made for the Sanderson Brothers' Steel Co., Syracuse, N. Y., had the two halves cast at once, and while still red they were clamped together and cooled so as to secure a fit without machining. At this time the work was done at the Straight Line Engine Works, and John E. Sweet carried out an idea he had long had in mind—that the correct method was to part the mold at the corners and make the joints as shown in Fig. 2. The halves were located endwise by halving at the bottom as shown by the dotted line. This not only put the fin (which was pretty sure to exist where the two halves came together) on the corner where it was more easily removed, but put the joint in a much better form for cleaning off the sand before closing, which was always an unsatisfactory job at the best. A couple of patterns were made and several molds made from them, but others offered better terms and the engine company had no occasion to follow it up. The plan of putting the molds together in the foundry was abandoned, and planing the joint



so as to secure a better fit, as had always been done by others, was adopted.

The making of the molds was again taken up by the engine company and Mr. Sweet improved his plan and settled on the form shown in Figs. 3 and 4. The object of parting on the corners has been explained, but the method of joining possesses the advantage that the two halves can be made from one pattern, and if the pattern warps it makes no difference, as the two halves will be alike and will match up at the joint inside, and hence produce ingots free from fins.

Another feature shown is that of locating the two halves endwise. This is done by a lug on each half at the top, engaging with a recess on the opposite side of the other half as in Fig. 4. These lugs and recesses being outside of those parts that make the joint do not interfere with the planing; hence the two halves are put upon the planer and planed at once, insuring a perfect fit. The cast ingot is more perfect and the mold is made at a reduced cost. This improvement is the subject of a patent recently allowed President Sweet, of the Straight Line Engine Co.—*The Iron Trade Review.*

The Apprentice Question.

I do not think there is any question in connection with the iron molder's trade where more difference of opinion exists than upon the above. All writers appear to agree upon one point, however, and that is the one unquestionable fact that out of every 100 apprentices who serve their time at the general jobbing trade, there are not more than 5 per cent who can be termed really first-class journeymen. The remaining 95 per cent will blame their employer, the foreman, or both, as the principal cause of their non-success. They will tell you that they never had a chance on the best class of work; they were always kept pegging away on inferior stuff until they lost interest in the business. I am quite willing to admit that there is a lot of truth in this assertion, but the question naturally arises, why were they kept year after year on in-

ferior work? The answer is, because they had done so badly while on a low grade of work that the foreman would not run the risk of giving them anything better.

I contend the foreman was perfectly justified in adopting this course under such circumstances. The result is the same in all walks of life, whether in trade, business, or the various professions. If a man starts in a small way in business, and takes no interest therein, there is very little chance of it growing any larger. If a doctor makes a mess of setting a broken finger, there is not much chance of his being called in to set a broken leg. The same rule applies in all walks of life, and the same excuse for failure is given in all cases. It is not the business man or the doctor who thinks he is to blame for his own want of success, but his employer, or the foreman, or the general public, anybody and everybody but himself. What is apparent to the employer or foreman evidently does not occur to these unfortunate individuals, viz.: that they have simply "missed their vocation." How often do we hear the expression thoughtlessly used "he is a 'born molder,' he can make anything with or without tackle, nothing seems to trouble him." If we happen to be in a thoughtful mood what significance these words have when we look around the shop and consider the number of molders there are, and the years many of them have been working at the trade, in comparison to the individual named above.

During an experience of over twenty years as an iron molder, I have taken particular notice of the apprentices, both during their apprenticeship and after they have served their time, and I have kept in touch with them in other shops and other cities, and found that 90 per cent of the second-rate ones have remained second-raters. A change from one shop to another, or the effluence of time, has made very little difference in them as efficient tradesmen. On the other hand, I have invariably found that an apprentice who took an interest in his work, and proved by the quality of his castings, that his heart and head were there, was always sure of rapid promotion, not because the foreman has taken a fancy to the boy, as some molders will assert, but because it is to the interest of the employer and the foreman to turn out good work as cheaply as possible. A foreman of a shop is always pleased to see an apprentice getting on, and will give him every encouragement, up to a certain point, but if the promising apprentice should make a mess of one or two good castings, sentiment will not prevent the foreman from putting him down a peg or two as a lesson for the future, and if the apprentice is made of the right stuff, the lesson will have a beneficial result. He will endeavor to prove by the quality of his work that his failures were due to want of experience and not from want of thought or care in the execution of his work, and will gradually, but surely, regain his former prestige. The observant molder will find it an extremely interesting study, to watch the various boys as they enter the shop and progress through their term of apprenticeship.

There are one or two peculiar contradictions I have met with among the many apprentices who have served their apprenticeship under my observation during the last few years. I give these illustrations to show how easy it is for an employer or foreman to make a mistake in engaging an apprentice if they depend upon their ability to judge a boy's qualifications from his appearance. In giving these illustrations I have no intention of trying to prove that the exception is the rule. I simply wish to show how easy it is to make a mistake in selecting boys by appearances. I have observed these contradictions on three occasions, several years intervening between each case. I have taken boys who have started their apprenticeship within a few months of each other. These boys were of two classes, one entirely opposite to the other. One set were smartly built, active, well educated and willing. They were liked by all hands in the shop, and were given every opportunity and encouragement to learn their trade, but in spite of apparent natural advantages and good opportunities they turned out rank duffers. The other boys were loosely built, dull looking, hesitating in conversation, and, judging from their manner, did not know the meaning of the word "politeness." Neither of them made a particularly brilliant start at the business, but they each possessed three notable characteristics to a greater or less extent. They were very persevering, they never started a job first and thought how to make it afterwards, if they did not know

themselves they were never backward in asking someone who did; if they had a bad lift and the foreman put his foot through their cope part, it did not upset their equanimity in the least, they simply rammed it up again. These boys have been journeymen molders now for some years, they are all in constant employment, one of them is the leading hand in the shop where he served his time, the other two are good general jobbing molders and are receiving the highest wages paid in the localities where they are employed.

These illustrations prove two things, first, that because a boy is polite, well educated, well built, active and willing, it does not necessarily follow that he is able to fill any position or learn any trade. Secondly, because a boy happens to be rather a slouch in appearance, a dull conversationalist, and perhaps rather uncouth in manner, it is wrong to conclude that he will never make a good tradesman. We are constantly reading biographical sketches of successful men, many of whom cannot write their own names, or put two or three sentences together intelligently, yet they have been successful simply because they have had the natural aptitude for the positions they have occupied. It is very much to be regretted that so many boys should be apprenticed to trades for which, in a great many cases, they have neither ability nor inclination, and are thus compelled through no fault of their own, to work at a calling all their lives in which they have no ambition and very little interest, unless they happen to be fortunate enough to find more congenial employment elsewhere. I suppose this unsatisfactory state of affairs will continue, in a greater or lesser degree, for all time, but it has occurred to me that the evil might be considerably minimized if we were to call the phrenologist to our assistance in this matter. Every boy in presenting his application for employment should be compelled to present his phrenological chart; if he possesses the characteristics required for the molders' trade, which I think are self-reliance, determination, constructive ability and ingenuity, he should be taken on trial for 12 months, if at the end of the 12 months he has proved his qualifications to the satisfaction of his employer, and if he has a liking for the business, let him finish his term of apprenticeship, as there is every likelihood that he will turn out a good tradesman; but if at the end of 12 months he has not shown any ability, or if he does not feel disposed to continue at the trade, his services should be dispensed with at once. It would be better for the boy to waste one year of his life rather than the whole. I am quite sure if employers were to give this method a fair trial, they would find the result much more satisfactory than the present haphazard system of judging from appearance, and the percentage of efficient tradesmen would be much higher than at present.

HARRY WILLIS.

Deaths.

Thomas I. Rankin, general superintendent of the Abram Cox Stove Co., Philadelphia died March 22. He was born in England 45 years ago and came to this country at the age of eight, the family settling in Boston, where Mr. Rankin learned the patternmakers' trade.

THOMAS I. RANKIN.

Later he moved to St. Louis, and about fifteen years ago became connected with the Abram Cox Stove Co. He took an active interest in all questions relating to the foundry trade and for two years was president of the Philadelphia Foundrymen's Association.

Lorenzo S. Dickey, general manager of the Macbeth Iron Co., Cleveland, O., died suddenly April 16 at the age of 38.

Oliver P. Scaife, of the Scaife Foundry & Machine Co., Pittsburg, Pa., died recently at the age of 67.

John B. Morris, president and founder of the foundry company which bears his name,

died at Cincinnati, recently, aged 67. He is succeeded by his son, George McG. Morris, formerly secretary of the company.

William McDonald, founder of the Lapeer Steam Engine Works, Lapeer, Mich., died recently, aged 84. He was born in Scotland and came to this country more than half a century ago.

S. Morgan Smith, president of the S. Morgan Smith Co., of York, Pa., manufacturers of water wheels, died on April 12 at Los Angeles Cal., where he had gone for the benefit of his health. Mr. Smith was 65 years old.

Among the Foundries.

The Charles Ross & Son Co., of Brooklyn, N. Y., will build a new foundry and machine shop for which a site has been purchased.

The Deering Division of the International Harvester Co. has placed its new gray iron foundry at Hamilton, Ontario, in operation.

The Meekers Union Foundry Corporation, of Norwalk, Conn., has been incorporated with a capital stock of $20,000 by E. A., Aurelius J. and Silas B. Meeker.

The Stacey Mfg. Co., of Cincinnati, O., will erect a new manufacturing plant at Elmwood Place. The plans call for a machine shop 130x500 feet, foundry 90x200 feet, pattern shop 30x60 feet and a fireproof pattern vault 30x30 feet.

The Manitoba Iron Works Co. of Winnipeg, Man., have plans for a new plant, including foundry and pattern shop.

It is announced that the Oregon Short Line will soon commence building its car shops and foundry at Pocatello, Idaho.

The Scranton Steam Pump Co., of Scranton, Pa., has secured the entire plant of the American Machine & Foundry Co., at Kingston, Pa., which will hereafter be known as the Wyoming Valley branch of the Scranton Co. The foundry of the latter concern has recently been increased and now occupies a space of 135x280 feet.

The Morgan Wood & Iron Works, Spartanburg, S. C., is incorporated with a capital stock of $40,000 to succeed the Morgan Iron Works. W. M. Jones is president and treasurer, and W. L. Montgomery, secretary.

The Hickox, Mull & Hill Mfg. Co., of Bowling Green, O., has increased its capital stock from $75,000 to $300,000. The officers are: President, E. P. Mull, vice-president, J. G. Hickox; secretary-treasurer, Geo. B. Yerkes.

The Hamilton Metal Pattern Co. of Hamilton, O., have purchased the Miami Brass Works and will erect a new foundry 50x82 feet to take care of increasing business. The officers are: W. Brown, president; Chas. A. Bosch, vice-president; Paul Sohngen, secretary and treasurer. John Kaefer has been selected as general superintendent.

Wm. H. Osborne, of the Wisconsin Malleable Iron Co., Milwaukee, Wis., has purchased a controlling interest in the Lakeside Malleable Iron Co. of Racine, Wis., which will be reorganized with a capital stock of $75,000. It is expected that several improvements will be made during the year.

W. McGibbons has opened a foundry and machine shop at Winlock, Wash.

The Newport Iron & Brass Foundry Co., Newport, Ky., is preparing to materially increase the size of its plant.

The Copper Queen Consolidated Mining Co. will shortly place its new shops at Douglas, Ariz., in operation.

B. F. Shuart has purchased the plant of the Elyria Foundry & Machine Co. at Elyria, O.

The Moncrief Furnace & Foundry Co., Atlanta, Ga., is building a foundry 60x80 feet. In addition to supplying itself with furnace castings a general jobbing business will be done in both iron and brass.

The Boulder Iron, Plumbing & Heating Works has been organized at Boulder, Colo., to conduct a general foundry. The new concern has the following officers: J. J. McCabe, president; Thos. Antrey, vice-president; D. L. Wise, secretary and treasurer.

The Eagle Foundry & Machine Co., of Allegheny, Pa., is having plans prepared for a new foundry of fireproof construction.

The Gurney Foundry Co., Toronto, Ont., manufacturers of stoves, furnaces, radiators, etc., has nearly completed its new plant at Toronto Junction, which will double its present capacity. It is also intended to install considerable new equipment in the Toronto plant.

The Gadsden Car, Foundry & Machine Co., Gadsden, Ala., has changed its name to the Gadsden Car & Machine Co. and increased its capital stock to $50,000. The officers of the company are: President, J. A. Blount; vice-president, R. B. Kyle; treasurer, Phil. L. Fitzgerald; secretary, Chas. P. Smith; general manager, J. L. Day, and superintendent, John R. Proctor.

The Whale Creek Iron Works, recently organized at Brooklyn, N. Y., have secured the

plant at 372-392 Greenpoint avenue. The officers are: Andrew N. Petersen, president; Herman Behrens, secretary; Waldemar Jansen, treasurer.

The Pacific Jupiter Steel Co., of San Francisco, Cal., has commenced the erection of a plant for manufacturing steel castings. Work has already been completed on one of the main buildings, 50x100 feet, which will be used as a molding room and pattern shop, and a contract has been let for the construction and equipment of an adjoining structure, which will contain the steel casting department and cleaning and finishing rooms. Between the two buildings will be situated the drying ovens. The equipment will include a Siemens-Martin open-hearth acid furnace, with a daily capacity of 30 tons, and later it is intended to install a basic open-hearth furnace of 20 tons capacity, making the output 50 tons daily. It is expected that the works will be ready to start up early in July. Col. M. M. Ogden will be general manager and William A. Ruth superintendent.

The White Brass Castings Co. has been incorporated at Chicago with a capital of $100,000 by N. E. Murray, W. A. Winterburn and Fred De Cardy.

The Standard Engineering Co., of Ellwood City, Pa., has increased its capital stock from $200,000 to $300,000 to provide for enlargements, which will include a large foundry. The officers of the company are: Charles E. Wade, president; John M. Shaw, secretary, and C. D. Cobau, treasurer.

The Aurora Foundry & Machine Works, of Aurora, Mo., have been incorporated with a capital of $75,000.

The Crown Casting Co. of Jackson, O., will engage in the manufacture of ranges and stoves.

The Rigby-Clove Co. is building a foundry at Pendleton, Oregon, to be operated in connection with its works for turning out combined harvesters.

Frank Hurop will place in operation the White River Iron Foundry at Enumclaw, Wash.

The Mitchell Mfg. Co., of Portsmouth, O., is considering plans for the building of a foundry to supply its own demand for castings.

The Twin City Fence & Wire Works, of St. Paul, Minn., is building an extension to its plant.

The Howard Stove Co., of Savannah, Mo., has begun work on its branch factory at Vermilion, O. The foundry is to be 80x120 feet, and other buildings to be used for mounting and storage purposes will be 80x80 feet and 80x120 feet, two stories high. The plant is expected to be ready for operations by July 1st.

The Butler Street Foundry & Iron Co., of Chicago, has increased its capital stock from $25,000 to $75,000.

L. C. Tarras, owner of the Gate City foundry, Winona, Minn., will increase the capacity of his foundry in the near future.

The Buss Machinery Co. are making arrangements for the erection of a factory at Muskegon, Mich., to which it is intended to add a foundry later on.

Streeter, Roberts & Norton, of Utica, N. Y., have added a brass foundry to their other departments.

The American Steam Gauge & Valve Mfg. Co., Boston, Mass., has reincorporated under the laws of the State of New Jersey. The company operates a plant at Jamaica Plain and the plant of the Mowrey & Phillips Co. of Boston. Later on it is the intention to erect a new plant combining both of the present ones.

The Attica Foundry & Machine Co., of Attica, O., has been incorporated to succeed the firm of J. W. Hall & Sons.

The Williamsport Clutch & Pulley Co., of Williamsport, Pa., is building an extension 70x160 feet to its present plant.

The South Pittsburg Iron Works, recently organized at Claysville, Pa., to manufacture bridges, buildings and other structural work, have taken over the business of the Claysville Foundry & Mfg. Co. A foundry building 141 x65 feet is well under way, while work is progressing rapidly on another building which will be 180x80 feet.

The Quincy Engine Works, Quincy, Ill., will erect a 100-foot addition to its foundry during the year.

The Case Mfg. Co. has been organized at Stanton, Mich., to take over the business of George F. Case. The officers are: George F. Case, president; A. E. Palmer, vice-president; C. C. Jenks, secretary. I. M. Clark, treasurer. The plant will be removed to Kalkaska, Mich., where buildings are now under construction.

The Turner-Armstrong Brass Co., of Port Washington, Wis., has been incorporated with a capital stcok of $60,000 by William J. Turner, W. D. Armstrong and George E. Henry.

The Southern Pipe & Foundry Co. has been organized at Birmingham, Ala., with a capital

of $35,000. A pipe foundry will be established at North Birmingham.

The Massillon Foundry Co. has been incorporated at Massillon, O., by William R. Harrison and associates. The capital stock is $10,000.

The Scott Mfg. Co. has incorporated with a capital of $50,000 and will establish a plant at Keokuk, Iowa, for the manufacture of brick machinery.

The Garden City Fan Co. will shortly add a brass foundry to its plant at Niles, Mich.

The Excelsior Foundry Co., of Peoria, Ill., is planning to extend its plant.

Chas. Gilbert & Son, of Albany, Mo., have made arrangements for the removal of their plant to Fulton, Mo.

The Altoona Foundry & Machine Co., Altoona, Pa., is enlarging its plant to meet the demand for more floor space to turn out the work. The new wing now being erected is 30x70 feet. Plans have also been prepared for the erection of a new gray iron foundry 66x170 feet, a cleaning room 50x60 feet, a core room 40x48 feet, and a cupola building 35x50 feet.

The Brylgon Steel Foundry Co., of Reading, Pa., has completed arrangements for the removal of its plant to New Castle, Del., where a building 65x616 feet is to be erected. The new works are estimated to cost $250,000.

The U. S. Cast Iron Pipe & Foundry Co. will resume operations at its West Superior, Wis., plant upon the opening of navigation at that point.

The American Car & Foundry Co. has secured control of the Southern Car & Foundry Co., operating foundries at Anniston, Ala., Gadsden, Ala., and Memphis, Tenn.

The New England Steel Co. has been organized to operate a steel foundry in Boston, Mass., where offices have been opened in the Weld building. Eugene Edwards, formerly general manager of the United States Steel Co., West Everett, Mass., is the chief promoter of the new enterprise.

Edward Harrington, Son & Co., of Philadelphia, have had plans prepared for a foundry and factory building to be erected on a new site at Sixteenth and Callowhill streets.

The American Engineering & Foundry Co., Los Angeles, Cal., has been incorporated with a capital of $100,000. The directors are: Alpheus Rodman, W. E. B. Partridge, U. D. Partridge, G. Davis, Richard J. Dillon.

The Conshohocken (Pa.) Brass Co. has been incorporated with a capital of $5,000.

A consolidation of the interests of the Davis Walker-Cooper Co., of Youngstown, O., and the Girard Foundry & Machine Co., of Girard, O., has been effected and the Youngstown plant will be moved to Girard. The new company will be presided over by Emanuel Hartzell as president; G. M. Gundy, secretary and treasurer; Frank Deemer, general manager, and James Cooper, superintendent. Plans for a new foundry and machine shop are being prepared.

The Phosphor Bronze Smelting Co., of Philadelphia, will increase the capacity of its foundry.

The Youngstown Bronze Co., Youngstown, O., will erect an iron foundry 85x120 feet, which will be equipped for doing heavy as well as light casting.

The Dacotah Machinery Co. will build a foundry and machine shop at Devil's Lake, N. D.

The Toledo Plow Co., Toledo, O., will extend its present foundry 70 feet, doubling the capacity of this department.

Under the name of the Washington Machinery Co., H. G. Manning and G. M. Davis, of Washington, Pa., propose to erect a general jobbing foundry and machine works.

The Hoquiam Iron Co., Hoquiam, Wash., has placed its foundry in operation. S. S. Silvis is president and manager; Frank L. Morgan, secretary, and Harry Breakiron, treasurer.

The Straight Line Engine Co., of Syracuse, N. Y., has awarded the contract for an addition to its foundry 92x160 feet, to cost $25,000.

The Lidgerwood Mfg. Co., of Brooklyn, N. Y., has purchased a site at Newark, N. J., and it is expected that all of the company's manufacturing departments will ultimately be transferred to that point.

Fires.

The Ironton Foundry Co., Ironton, Ohio, sustained considerable loss through a recent fire.

The John Rice & Bros. Co., of Stevens Point, Wis., had their plant damaged by fire April 7. The loss is covered by insurance.

The Neill Stove Mfg. Co., of Portsmouth, O., lost its plant through a fire March 28.

The foundry of the Bates Machine Co., Joliet, Ill., burned April 4.

The Corning Stove Works, Corning, N. Y. was visited by a disastrous fire on the morning of March 21, which wiped out its molding room and all the stove patterns which were kept in that part of the establishment. The fire penetrated into the mounting room and did some damage there. The total loss is estimated at from $10,000 to $15,000, all of which was practically covered by insurance.

The Blakeslee Foundry Co., of Cleveland, O., operated in connection with the Ajax Mfg. Co., had its plant badly damaged by a recent fire.

The Jenison Iron & Engineering Works, Jenison, Mich., burned March 21, causing a loss of $40,000, fully covered by insurance.

Refractory Materials.

Much of the success of metallurgical operations depends upon the condition of the interior of furnaces, upon the length of time these interior portions will resist intense or intermittent heats, reducing or oxidizing atmospheres, on the scouring action of basic oxides, and on the general wear and tear to which such structures are exposed. In certain cases, as, for instance, the basic Bessemer or open-hearth steel-making process, the lining itself plays no small part in the actual conduct of the operation. Briefly, then, the general conditions refractory materials are expected to meet include:

1. The expansion or contraction due to heating and cooling, resulting from intermittent working.

2. The cutting action of flames, the abrading effect of molten metal, and the searching action of metallic oxides or scouring slags.

3. Variations in atmosphere, such as reducing or oxidizing.

4. Mechanical properties, such as to withstand the rough wear and tear of charging solid metal—often in heavy weights—and other more or less rough treatment to which these furnaces are subject.

It will be seen that these requirements are by no means light or easy to meet. Nevertheless, nature, always bountiful, has provided many substances which, used in combination with mechanical skill and scientific knowledge, enable the metallurgist more or less successfully to meet the ever-increasing strain to which his furnaces are subject. A brief resume of these materials and of their general properties may not be without interest, and as the keener conditions of today demand that every detail be studied and worked to the best advantage, no apology is necessary for introducing the subject of furnace linings.

This matter, dear to the heart—more so to the pocket—of the furnace owner is one that will permit of development. Working temperatures are increasing and a corresponding increase in the refractivity of brick or crucible must follow. Brass founders demand crucibles of higher earning capacity, of longer working life. The crucible steel founder requires in the materials composing his pots a combination that will successfully and commercially produce steels of dead mild quality. It is hardly necessary to remind my readers that in the ordinary clay steel melting pot carbon is taken up from the coke dust used in the crucible mixture, and at the same time silicon is reduced from the silica of the clay, also passing into the steel. These reactions are easily allowed for in producing average or ordinary qualities of steel, but assume importance in the case of extremely mild qualities of metal such as are required in electrical construction.

It is hardly necessary to refer to the important part played by the refractory materials in the construction and working life of a modern open-hearth furnace. Such a plant may run a long and profitable life, or it may fail entirely when comparatively few tons of steel have been produced.

The key to the four requirements quoted earlier in the paper lies in clear scientific knowledge of the materials handled and correct mechanical use of them. For general purposes refractory materials may be conveniently grouped into the three following classes: (1) Acid, (2) neutral, (3) basic.

ACID REFRACTORIES.

The first group or acid variety consists chiefly of silica, the oxide of silicon, which is found plentifully distributed in the crust of the earth. Silica acting as an acid will combine with various bases forming fusible silicates—a fact of no little import to the furnace builder. Acids, with the one exception of hydrofluoric, have no solvent action on silica, but it is readily soluble in alkaline solutions. It is extremely refractory, and can only be fused at the highest temperature of the oxy-hydrogen blow pipe. In nature silica is found in the form of quartz, and in a less pure state as flint, chalcedony, agate, etc. Sand is usually quartz, sometimes flint in a minute state of division, in which form silica constitutes all sandstones.

Silica is known to the mineralogist in four

forms: (1) Quartz and its varieties, (2) Chalcedony and its varieties, (3) Jasper and its varieties, (4) Hydrous silica and its varieties. The forms of silica of immediate interest to the metallurgist are varieties of sandstones, which when used in a native state are technically known as "firestones," various sands, ganisters and similar silicious materials which may be used in practice in a natural state or after suitable treatment in the form of bricks, etc. Ganister, a local name for an argillaceous sandstone found in the carboniferous formations of South Yorkshire and other districts of Great Britain, is a close-grained, dark-colored rock. It is a fine-grained sandstone, containing no mica and possessing therefore no cleavage. The clayey matter is present in just sufficient quantity to allow of the material being molded. Analysis varies within the following limits:

Silica	87	to 95	per cent
Alumina	4	to 5	per cent
Ferric oxide	0	to 0.8	per cent
Lime and magnesia	0.25	to 0.75	per cent
Alkalis	0	to 1	per cent

An analysis of a Yorkshire ganister yielded in the writer's hands:

Silica	95 per cent
Alumina	3 per cent
Ferric oxide	1.5 per cent
Lime and magnesia	0.5 per cent

The ganister is ground under edge runners into a coarse powder, and if the mass does not "bind" well, lime cream may be added, which when burned forms silicate of lime—in effect a glazed surface. This addition of lime must in all cases be kept low, and only added when the composition warrants it. Otherwise the essential properties of the material are destroyed. Ganister in this condition is used for lining the acid Bessemer converters, cupola furnaces, crucible, and, in fact, any form of furnace which will permit of the material being rammed round a wooden model. On the other hand, this ganister ground may be molded into fire bricks, which on the market are commercially known as silica brick and permit of a most extensive use in the construction of any form of acid furnace. The composition of silica bricks varies as follows:

Silica	90	to 96.0	per cent
Alumina	3	to 5.0	per cent
Ferric oxide	0.8	to 2.0	per cent
Lime	0.25	to 1.0	per cent
Magnesia	0.1	to 0.5	per cent
Alkalis	0.5	to 1.0	per cent

In constructing furnaces of these bricks good allowance must be made for expansion and all tie rods must be fitted with automatic springs to enable them to meet the expansive and contractive strains.

Of the various sands which form members of the acid group it is only necessary to notice one briefly—silica sand, or as it is sometimes termed, Belgium white sand. The hearth portion of an acid furnace is usually formed of a boiler plate shell, lined first with fire brick, then silica brick, and the bath proper formed of silica sand. This sand is extremely refractory and in practice, to make it slightly fuse over, about five per cent of red sand is mixed with the white sand. This bath must be kept in good trim, or, as the melter terms it, "good fettle," and after each heat all worn places or "pools" must be sanded up again and the whole surface of the bath brought to the proper shape. This is readily done, after tapping, by throwing sand with long handled shovels onto all the uneven places and slightly fusing over to level down again. It is an axiom in open-hearth practice that a bad or uneven bottom is fatal to good steel-making and therefore too much care cannot be devoted to this point.

Many silicious or quartzose rocks as sandstones, granites, millstone grits, serpentines, steatites, etc., are highly refractory, will resist changes in temperature without cracking. Hence the use of these rocks as "firestones" on hearth stones of blast furnaces, cementation boxes and in the construction of reverberatory furnaces, etc. In the case of sandstones special care must be taken to bed them in the plane of their stratification to prevent exfoliation; and herein lies one of the chief difficulties in using natural stones for furnace construction. Among other acid materials may be mentioned the use of calcined and ground flints, which are nearly pure silica and consequently highly refractory.

NEUTRAL MATERIALS.

The second group of our classification, that of neutral materials, offers wide scope to the metallurgist. They are termed neutral, owing to the fact that they form no compounds with either basic or acid materials. Hence a neutral material can be used as an isolating medium in the construction of basic furnaces, between basic and acid material. For instance, silica brick may be used to form the roof and the introduction of an isolating layer of, say, chromite, will permit of a basic bed of bauxite or of dolomite. The combination of acid and base has been shown in the introduction of lime to a ganister in order to increase the binding qualities by glazing over the surface

with silicate of lime. Hence the importance of purely neutral materials is readily apparent, for as is well known acid and basic materials highly refractory in themselves, when in contact at furnace temperatures result in a more or less fluid slag.

Among the materials composing this group may be mentioned various clays, resulting from the decomposition of granites and felspars, carbon in the form of graphite, coke dust, anthracite and the extremely refractory material, chromite.

Some varieties of chromite are extremely refractory—almost more so than silica—and a further advantage is that owing to the neutral property it is unaffected by the presence of either basic or acid elements. It remains practically the same in either reducing or oxidizing atmosphere, a property not possessed by other neutral materials, as for instance carbon. Its chief mechanical drawback is the lack of cohesion. The composition varies within the following wide limits:

Chromic oxide	40 to 60 per cent
Magnesia	6 to 18 per cent
Ferrous oxide	15 to 36 per cent
Alumina	5 to 30 per cent
Ferric oxide	0 to 21 per cent

In building basic furnaces it is of an undoubted advantage to build the roof and sides, or those portions which play no chemical part in the conduct of the operation, of an acid material, such as silica brick. As already stated, to allow the acid sides and basic bed to come in contact with each other at high temperatures would be disastrous and hence in acting as an isolating medium between acid and basic, chromite fills an invaluable position. Up to the present chromite has been found chiefly in the Shetland Islands, in the Bare Hills, Baltimore; in the Ural Mountains and in the Dun Mountains of New Zealand.

Carbon in the form of graphite or plumbago is extremely refractory and will successfully resist high temperatures. In a reducing atmosphere it is practically infusible, though when in a fine state of division and with free access of oxygen it will slowly burn, forming carbon dioxide. The purer forms of graphite contain from 94 to 96 per cent of carbon, but in inferior samples the content of carbon may not exceed 36 per cent, the remainder consisting of variable amounts of ash which is chiefly composed of iron, silica and earthy matters.

	Normal graphite	Ceylon picked
Carbon	80 per cent	99.8 per cent
Ash	16 per cent	.1 per cent
Volatile products	4 per cent	.1 per cent

In commercial samples the ferric oxide which constitutes the larger portion of the ash is removed by digesting with sulphuric acid. The graphite is then ground, sifted, kneaded and left for some little time to "temper." The chief metallurgical application of graphite is in the manufacture of plumbago crucibles which contain from 25 to 50 per cent of this material, the remainder consisting of mixtures of various fire clays. These crucibles or "pots" as they are technically termed, are in contrast with clay ones very durable. After careful annealing they will stand repeated reheating and cooling. Used to a limited extent in steel-melting practice these crucibles find their chief field in the production of bronze, brass and various industrial alloys.

BASIC MATERIALS.

Infusible bodies strongly basic in character come under this heading, chief of which are bauxite lime, dolomite and magnesia. The basic property of these materials is taken advantage of in certain steel-making processes to abstract the phosphoric acid from the iron, forming slags of stable phosphates.

Lime, in the absence of an acid such as silica is one of the most refractory substances known, being practically infusible. Crucibles of lime are used for the fusion of platinum. Owing to its tendency to become hydrated and consequently to disintegrate, lime cannot be extensively used in furnace construction and when used at all the operations must be continuous. Magnesia is extremely refractory and crucibles or bricks of this material resist high temperatures very successfully, but on account of its high initial cost it does not meet with very extensive adoption.

Magnesite, the carbonate of magnesia, is used as a source of that material. Its composition when pure is: Magnesia, 48.73 per cent; carbonic acid, 51.27 per cent. But it may contain in addition more or less lime, silicates of iron and free silica.

Dolomite, or magnesium limestone, is a double carbonate of lime and magnesia and in a pure state consists of: Carbonate of lime, 54.35 per cent; carbonate of magnesia, 45.65 per cent. In less pure forms it is found associated with more or less iron, manganese and silica. The latter, if not in excess, plays a not unimportant part in adapting the material to furnace requirements. Dolomite lacks coherence and to overcome this defect in the manufacture of brick the silica occurring with, or purposely added to, the dolomite in small quantities is fused, while the bricks are being

fired, at a high temperature into a silicate forming a " frit" which binds the whole together. Dolomite before being made into brick must be calcined at a high temperature. It is then ground and mixed with anhydrous tar which binds the mass together whilst being pressed into shape, and until the bricks are fired. They may afterwards be protected from atmospheric influences by a coating of tar. For lining the beds of furnaces the calcined and powdered dolomite, again mixed with tar to give the necessary consistency, is rammed to the requisite shape. This bed is gently heated to drive off the tar and the surface fused over as in the case of the brick.

The aluminates of iron are very infusible and of these bauxite, a hydrated ferric aluminate, is the most representative. Owing to its capacity for resisting the action of metallic oxides bauxite is somewhat extensively used for lining the beds of basic open-hearth furnaces and is applied in a similar manner to dolomite. Its composition varies as follows:

Alumina	50 to 60 per cent
Ferric oxide	10 to 25 per cent
Silica	3 to 5 per cent
Water	10 to 15 per cent

Some varieties of bauxite give better working results when mixed with about 3 per cent of clay and with from 2 to 6 per cent plumbago.

From this necessarily brief survey of an important matter it will be seen that the refractory materials of nature, though bountifully dispersed, require more or less mechanical treatment to bring them within industrial conditions. It is to this mechanical treatment and chemical knowledge of the materials handled, combined with an exact estimate of the particular duty a furnace may have to perform, that the furnace builder must look if he wishes his structures to yield the maximum output.—[Percy Longmuir in *Iron Trade Review*.

Encouraging Suggestions.

To secure the active co-operation of its employes is a problem that confronts every manufacturer. The man who hangs back and performs as little as he can is not a very desirable member to have in any establishment, and but little above him we have the individual who has his mind on one thing and his hands on another. There will always be workmen of this kind, though it must be admitted that the percentage of same may be lowered through encouraging workers to think and act on their own account for a firm's interest.

The offering of prizes for suggestions leading to improvements in manufacturing is a method several concerns have tried whereby to infuse enthusiasm into its workmen. This system has recently been adopted by the Richardson & Boynton Co., of Dover, N. J., who have issued an announcement to their employes from which we take the following:

The Richardson & Boynton Co., of Dover, N. J., offer the following 20 prizes for the best suggestions offered by any of their employes in writing, between now and November 1, 1903:

First prize	$50.00 in gold coin.
Second prize	35.00
Three prizes	25.00 each.
Five prizes	15.00 each.
Ten prizes	10.00 each.

Locked suggestion boxes will be placed in each department and opened twice a week. All suggestions to be in writing and signed.

We want all our employes to feel that they can make suggestions freely without fear or hindrance, or in any way injuring themselves in the estimation of the superintendent of their department. On the contrary, every good, practical suggestion made will help the standing of the one so making it in his department, as well as with the concern.

Examine the work that you are doing and see if you can think of any way to do it better, easier or cheaper. Perhaps the work already done before it reaches you could be altered so as to make your work easier and at no additional cost to us. Look around and see where you can improve your work. This will help you as well as us. We want to help the men who help us.

You cannot afford to have our goods cost more than the same character of goods made elsewhere cost, because if our goods do not cost us any more than our competitors have to pay we can increase our business, which, in turn, means increased work and more men employed. The lower the cost of goods produced the greater the output, and the greater the production the greater the number of men employed. Cheapening the cost of production means that the goods can be sold at a lower price, and also means larger production, more work and more men employed.

All suggestions will be investigated, and, if approved, will be adopted as soon as possible. Suggestions that are not adopted by us will be destroyed. Prizes will be awarded in November next, and notice will then be posted as to the next award.

The Metallurgical Section of the American Foundrymen's Association.*

BY HERBERT E. FIELD.

The various committees of the American Foundrymen's Association have heretofore taken care of the problems which have arisen in connection with the advent of metallurgy into foundry practice. Owing to the increasing demand thus placed upon the association a separate section has been organized to take care of this branch of foundry progress. This section is designed to act as a central exchange for ideas and to direct the advancement of metallurgy in its relation to foundry and furnace practice. Foundry chemistry and foundry metallurgy have, like all new movements, been hampered by insufficient knowledge and by misleading statements made by inexperienced writers. These writers have been without doubt sincere in their opinions, but they have, nevertheless, done immeasurable harm to the advancement of chemistry in foundry practice. They wrote at a time when little was known about the subject and whatever was said was accepted as truth and practiced as such. When the expected results were not achieved, metallurgy was condemned while in reality it was the lack of correct knowledge for its application which was at fault.

Individual chemists have from time to time brought before foundrymen the results of experiments which have proved of great value. These results have, however, lacked the backing which a strong association would have given them, and often passed unnoticed, or, if noticed at all, have been classed with the mass of unreliable matter previously mentioned. This section intends to systematically investigate debated problems and to place before the members for their use the results of these investigations in such a manner as to warrant their acceptance or rejection as correct bases for practical work. There are new propositions continually coming up in this branch of practice which are now slowly and tediously worked out by individual metallurgists in the spare time they have at their command. The metallurgical section by distributing such work and placing parts of it where it can be most conveniently carried out will be able to greatly expedite these investigations. These problems will be brought before scientific institutions whose equipment and experience in original research will enable them to make a thorough and correct solution of that side of the question. The practical work in connection with the investigations will be done by founders whose equipment is best suited to the matter under consideration. The practical and scientific will thus be combined in a manner which has been much talked of but never accomplished.

Our technical schools are more than anxious to do their part, while foundries are expressing an increasing interest in the work. A strong organization to direct is necessary to complete the success.

Numerous problems arise in regard to iron which cannot be solved by the foundryman. They can only be worked out at the pig iron furnaces. The furnacemen, by their endeavors to find out just what compositions and characteristics are wanted by the foundryman, show that they are alive to the fact that there is much room for study and improvement in their line. The first suggestion for the formation of such a section came from the selling end of the pig iron trade, and this section expects to count pig iron furnaces among its strongest members.

Chemistry is to have a more useful position in furnace and foundry practice. This is plainly shown by the statement of prominent pig iron and foundry men in the recent issues of trade papers. Agitation in regard to grading, sampling and standardizing indicates the great interest now manifest in this line of work. Progress has been, and will continue to be made, whether such an association is formed to aid it or not. If, however, the labor lost by duplication can be avoided and investigations carried on under the most auspicious circumstances, much greater progress will be made and advancement will be more rapid.

The first problem brought before the section for solution is that of standardizing methods for the analysis of iron. The increasing complaint of furnaceman and founder that the analysis of different chemists did not agree, induced the American Foundrymen's Association to refer the matter to its standardizing committee with the idea that this committee could adopt a series of standard methods for iron analyses, and thus obviate the error due to the difference in the methods used. This work has since been referred to the metallurgical section, and the classifying and editing of the various methods now in use are being done by its secretary. The methods sent to the stand-

*From the *Journal* of the American Foundrymen's Association.

ardizing committee prove that there are many now in use in chemical laboratories which are inaccurate and unreliable. Whether this association adopts a set of standard methods or not, it will point out as inaccurate, many methods now in use in iron work.

Many founders are having their analyses made by independent laboratories, and at the suggestion of these founders it was decided to include these laboratories in the list of those who are available for membership in this section. They have shown a decided interest in the work and will make a valuable addition to the association and the metallurgical section will be of great practical value to them.

This section, then, is organized for any who are engaged in the study or practice of chemistry and metallurgy of iron. There is no intention of taking the place of or interfering with the work of any other society. This is a time of specialists. We are, it is true, interested in the work of our fellow scientists in all other lines of work and would be the last to lessen in any way the great good being accomplished by our national scientific societies. There is, however, a crying need in the iron business for an association active, alive, and awake to the conditions and opportunities of the times. An association before which papers may be read? Yes! But an association which will help and educate its members in the metallurgical side of the iron business, an association which, proceeding in a thorough and systematic manner, will investigate and solve problems arising in everyday practice of metallurgy in foundry and furnace work. It is this place that the metallurgical section is designed to fill, and will fill with credit to itself and to the American Foundrymen's Association, provided it is given the proper support.

A Method of Phosphorizing Metals.

The question of phosphorizing metals is one which has perplexed many a foundryman and the majority of them, while having tried at various times to introduce phosphorus into molten metals, have abandoned the matter in disgust and purchased their alloys in the metal market.

The difficulty which has confronted those who have attempted this operation has been the ready inflammability of phosphorus, which not only renders the situation dangerous but leaves the factor of uncertainty behind it so that, after the phosphorus has all been added, it becomes an open question about the amount of this element which the alloy contains. One foundryman says that he has never been able to get two heats alike, while another states that all of the phosphorus ignites before he is able to introduce it into the metal. Those who have tried this operation do not hesitate to say that it is one of the most unsatisfactory propositions in the alloying of metals.

It is the yellow variety of phosphorus which must be used, as the red kind is too expensive to permit of its employment, and those who are familiar with the former are fully aware of the necessity of keeping it under water. If left in the open air for a short time it spontaneously ignites; when kept in the water until one wishes to use it, the sticks must be dried before being inserted in the molten metal; a very difficult operation.

Under ordinary conditions there is an enormous waste in the introduction of phosphorus; in fact under those just mentioned it is not an exaggeration to say that only about five or six per cent enters the alloy.

The handling of phosphorus is always accompanied by much risk. Its burns are particularly dangerous and it cannot be touched by the hands. Then, too, its vapor or fumes will, if inhaled in sufficient quantity for any length of time, produce ulceration of the jaw bone. It may be readily seen, therefore, why the majority have had an adverse experience in the manufacture of phosphor-metals. Some, knowing the difficulties beforehand, have not dared to enter into the problem at all.

Most of these difficulties and particularly that of the easy inflammability may be overcome by an extremely simple operation: i. e., copper plating the sticks of phosphorus. Not plating them by means of electricity, but by their own property of reducing copper from its solutions.

The operation is carried out as follows, viz.: Dissolve one pound of blue vitrol (copper sulphate) in one gallon of cold water * in a glass or earthenware vessel. When dissolved, remove the sticks of phosphorus from the tin can in which they are shipped and place them in the solution. In a short time they will become covered with copper and if left sufficiently long a good thick coating will be obtained. The sticks must be moved about from time to time in order to prevent the portions which come in contact from remaining without being plated.

*It may be dissolved in hot water and then cooled, but care should be taken that the temperature is sufficiently low to obviate the melting of the phosphorus.

When left sufficiently long in the solution (about an hour is usually sufficient) the sticks may be removed and dried in sawdust or by absorbent paper. Great care should be used, however, in the removal of the sticks as they are quite brittle, and small portions may break off and thus expose the unplated material. If properly plated with the copper the phosphorus is now quite an ordinary substance and will not ignite spontaneously. Indeed, I have allowed, for the sake of test, a stick of phosphorus so plated to lie in the hot sun of an August midday for several hours without ignition having taken place. It is generally advisable to allow the sticks to remain in the air for half an hour or so after they have been dried, as the complete expulsion of moisture is then assured.

The phosphorus may now be inserted into the metal in any suitable manner; either by means of suitable tongs or a plumbago phosphorizer.

It may be well to add that, even though the danger of spontaneous ignition is, by this method, avoided, there is a loss of phosphorus in a more or less degree, depending upon the personal equation of the manipulator. It is conducive to better results, therefore, to make a rich phosphor alloy (such as phosphor copper) and determine the amount of phosphorus in it by an assay or other suitable means, and then use this rich alloy for adding the proper amount of phosphorus. Too much phosphorus in alloys is, in reality, worse than too little and unless care is exercised one is as liable to err on one side as the other.

Red phosphorus is made by heating the yellow variety to a temperature of 240 degrees C. in close vessels, when the change takes place. It is in the form of powder and while it does not ignite at ordinary temperatures and need not be kept under water, yet its cost is so much greater than the ordinary variety that the founder cannot afford to use it.—Erwin S. Sperry in *Aluminum World*.

Notes from Various Sources.

The Duplex Roller Bushing Co., Camden, Maine, manufacturers of the Wellman duplex roller bushing, have bought out the Belfast Machine & Foundry Co., Belfast, and will move their business to the latter city. The company will erect an addition 40x75 feet and continue the manufacture of special machinery formerly carried on by the Belfast company in connection with their own lines. F. C. Pitcher is president and general manager, and C. E. McIntyre treasurer.

The S. Obermayer Co., of Cincinnati, are placing on the market their Peerless Follow Board Compounds, which is claimed to produce perfect partings, with sharp, hard, durable edges. It is said not to swell or shrink and will make a light and strong match that improves with age. It is stated that a saving of 60 per cent is effected over the old method of making follow boards.

The Union Motor Co., of Portage, O., has been incorporated with a capital of $15,000 to manufacture gasoline engines. A foundry and machine shop will be erected as soon as plans are prepared.

The Crown Casting Co., of Jackson, O., is having plans prepared for an additional foundry building, 90x200 feet, which will be used for turning out stove castings, leaving the present plant for the manufacture of soil pipe.

The National Association of Stove Manufacturers will hold its annual convention in Cleveland May 12, 13 and 14, and preparations are being made to make this one of the notable gatherings of that body. An extensive programme for the entertainment of the visitors has been laid out by the local committee.

The Springfield Foundry Co., of Springfield, Mass., has purchased a site upon which it is contemplated to erect another foundry.

The Hempfield Foundry Co., of Greensburg Pa., will extend its foundry by an addition 40x90 feet. A pattern shop 24x40 feet is also being built.

The Field-Evans Iron Co. has been organized at Cincinnati with a capital of $200,000 and has taken over the business and agencies of Robert Field, David Evans and the Field-Croxton Iron Co. The general offices will remain in Cincinnati, in charge of Robert Field, first vice president and general manager. The Cleveland office will be looked after by William Wieman, second vice president. The Chicago office remains in charge of David Evans, president, while the St. Louis branch will remain under the direction of E. C. Smith as district manager. Among the agencies controlled by the company are those of the Sloss-Sheffield Steel & Iron Co. and the LaFollette Coal, Iron & Ry. Co.

The Bentel & Margedant Co., of Hamilton, O., will add to its foundry a building 50x80 feet, which will form a separate department for its pulley molding machines.

E. C. Welsh, foreman of the Norfolk & Western Ry. Co. at Roanoke, Va., has resigned to accept a similar position with the Barney & Smith Car Co., of Dayton, O. Mr. Welsh is succeeded by James E. Goens.

The Osceola Foundry & Specialty Co. has been incorporated at Osceola, Ind., with a capital of $10,000. The plant now located at Goshen will be removed to Osceola.

R. A. Rutherford & Co. is a new concern recently organized at Philadelphia for the manufacture of pneumatic tools, including hoists, cranes, motors and special machinery.

Gade & Hardenbrook will erect a plant at Iowa Falls, Iowa, for the manufacture of gasoline engines.

The Brooklyn Bronze Works, of Brooklyn N. Y., have been organized with a capital of $10,000 by Andrew N. Peterson, Waldemar Jansen and Frederick Lawrence.

The Fillmore Avenue Foundry & Iron Works, of Buffalo, N. Y., has been incorporated with a capital of $50,000.

One of our subscribers wants to know if it is practical to dry cores and molds by steam heat, and we shall be glad to receive information upon this point from those of our readers who have had experience along this line.

The Joseph Dixon Crucible Co., of Jersey City, N. J., has recently placed on the market a new form of crucible which is constructed upon the same principle as several of the self-skimming ladles previously illustrated in these columns. A partition extends nearly to the bottom of the crucible and forms a pouring spout in such a manner that the metal, as it is emptied, is taken from the lower part of the crucible, thereby preventing any dross to be found on the surface of the metal from entering the mold. This design of a crucible is said to have proven especially useful in the casting of such metals as babbitt and aluminum alloys, as well as the ordinary brass and bronze mixtures.

When the Milmine Iron & Steel Co., Toledo, O., recently incorporated, is thoroughly organized, it will succeed H. B. Milmine & Co., carrying on the same line of business, namely, structural steel work; all kinds of foundry work and a general supply business in wrought iron and steel products.

The Scottdale, Pa., plant of the U. S. Cast Iron Pipe & Foundry Co. is to be equipped for handling pipes of the largest size. The melting capacity will be increased to 300 tons daily and new testing equipment will be added.

The Adams Co., Dubuque, Iowa, has issued catalogue No. 9, which describes the Farwell molding machines manufactured by them. Many different designs are shown, covering a wide range of requirements by foundries engaged in producing different classes of castings. The Adams Co. was one of the pioneer concerns to employ molding machines on a large scale and their own experience has evidently confirmed them in the belief that in order to secure the greatest good from these the founder must learn to prepare his patterns so that they will work properly. Considerable information is given on this point and many illustrations shown of methods adopted in carding or mounting patterns of various kinds. The catalogue consists of 62 pages and a great part of its contents should not be classed as advertising matter as it is practical instructions in handling patterns, with which the majority of foundrymen should be acquainted. Attention is called to the necessity of using well built flasks that will stand the strain of machine molding. The subject of multiple molding is taken up and examples shown of what has been done in this direction.

The Standard Scale & Supply Co. will remove from Bellefonte to Beaver Falls, Pa. Among other buildings a foundry 80x142 feet will be erected.

The J. H. Gillon Machine Co., of Waycross, Ga., has purchased the Syphan Machine Works at that place and dismantled the plant.

The foundry of Yager Bros., Keokuk, Ia., is being enlarged.

The Nelson Gas Engine Works, of Harlan, Iowa, is building a new plant, including a foundry.

Geo. G. Blackwell, Sons & Co., Ltd., of Liverpool, Eng., have sent to the trade a second edition of their pamphlet on "Solid Ingots and Castings in Steel and Iron." It explains the characteristics of the Blackwell S. A. M. (silicon, aluminum, manganese) alloy and the results secured by its use. The prevention of blow holes, cracks and flaws is attained by a certain addition of the alloy to the molten metal. The elements of the alloy are converted by taking up the oxygen from the casting, into single, double or multiple silicates, borates, etc., which produce a readily fusible slag. This is quickly formed and rises in the form of globules through the liquid and heavier metal of the casting. Only a trace of the constituents of the alloy, estimated at less

than one-tenth of one per cent, remains in the finished casting.

The Blakeslee Mfg. Co., Du Quoin, Ill., is building a new foundry.

A branch of the Westinghouse Machine Co. is to be located in Attica, N. Y., the shops to make the Roney mechanical stokers and smokeless furnaces, which are controlled by the Westinghouse Co. About 200 men will be employed. The buildings will consist of a machine shop, 100x250 feet; a foundry, 60x500 feet; a pattern shop, 35x250 feet; a power house, 30x100 feet, and an office building.

The Principal Foundry in Mexico.

While there are a number of places where castings are made in the Republic of Mexico, the majority of these confine their operations principally to the cruder forms of foundry work, such as stamp shoes, grate bars and ordinary repair work for the mines. Among the two dozen foundries to be found in Mexico there is really but one which is of any importance, this being connected with the plant of the Monterey Foundry & Mfg. Co., Monterey. When the Mexicans want to mention this concern they get up early in the morning and say "Compania de Fundicion de Fierro y Manufacturera de Monterrey," an expression which ought to scare off competition from this side of the Rio Grande.

This foundry was established in 1892 by Col. J. A. Robertson and others interested in building railroads and promoting enterprises of various kinds. None of these knew anything about the foundry business or details of manufacturing and the plant did not prosper until 1896 when it was purchased by Col. James Meehan, of Covington, Ky., who together with his sons, G. F. and R. E. L. Meehan, are the principal stockholders.

Upon assuming control the new owners immediately proceeded to remodel the works and equip them with modern appliances. The plant consists of a foundry 70x150 feet, machine shop 55x185 feet, blacksmith shop 50x80 feet and a pattern and brass shop 50x100 feet. All kinds of machinery required by the mining, smelting and other interests of the country are manufactured, though a specialty is made of sugar machinery. Church and school furniture is also made. The Monterey Foundry & Mfg. Co. have found Mexican labor preferable in their foundry, having on a recent date about fifty molders in their employ of which only one was an American. The latter received $5.00 per day, Mexican currency, and first class native molders are paid at the same rate. As a general rule Mexican molders are not capable of producing the same amount of castings as the Americans, but it is claimed that they do their work nicely and appear to take to this trade much more readily than they do to other lines of industry. No labor unions exist in Mexico and there being no "minimum" rate, the pay each workman receives varies greatly and is of course depending upon his skill and the value his employer places upon his labor. The Mexican does not take as readily to the machinist's trade as he does to molding and in consequence the number of Americans employed by the Monterey Foundry & Mfg. Co. in their machine shop is relatively much higher than is the case in the foundry.

Hitherto the greater part of the iron and coke consumed by Mexican foundries has been secured from the United States, but furnaces are now being erected at Monterey which it is expected will be able to take care of the home trade. Part of the output of these furnaces will be converted into steel products. Experiments are also being made in the manufacture of domestic coke, which is reported to be improving in quality to such an extent that consumers are looking forward to the day when Mexican iron and steel industries will be independent of foreign producers.

Personal.

James Meehan, manager of the Ross-Meehan Foundry Co., Chattanooga, Tenn., will retire from business. He is succeeded by his son, Gus F. Meehan, who for several years has been identified with the Monterey Foundry & Mfg. Co., Monterey, Mexico.

Lew Kuhns has been selected as manager of the Altoona Foundry & Machine Co., Altoona, Pa.

E. J. Curry has been appointed foreman of the gray iron foundry of the Minnie Harvester Co., St. Paul, Minn.

Wm. Southerland has taken charge of the foundries of J. L. Mott & Co., New York City.